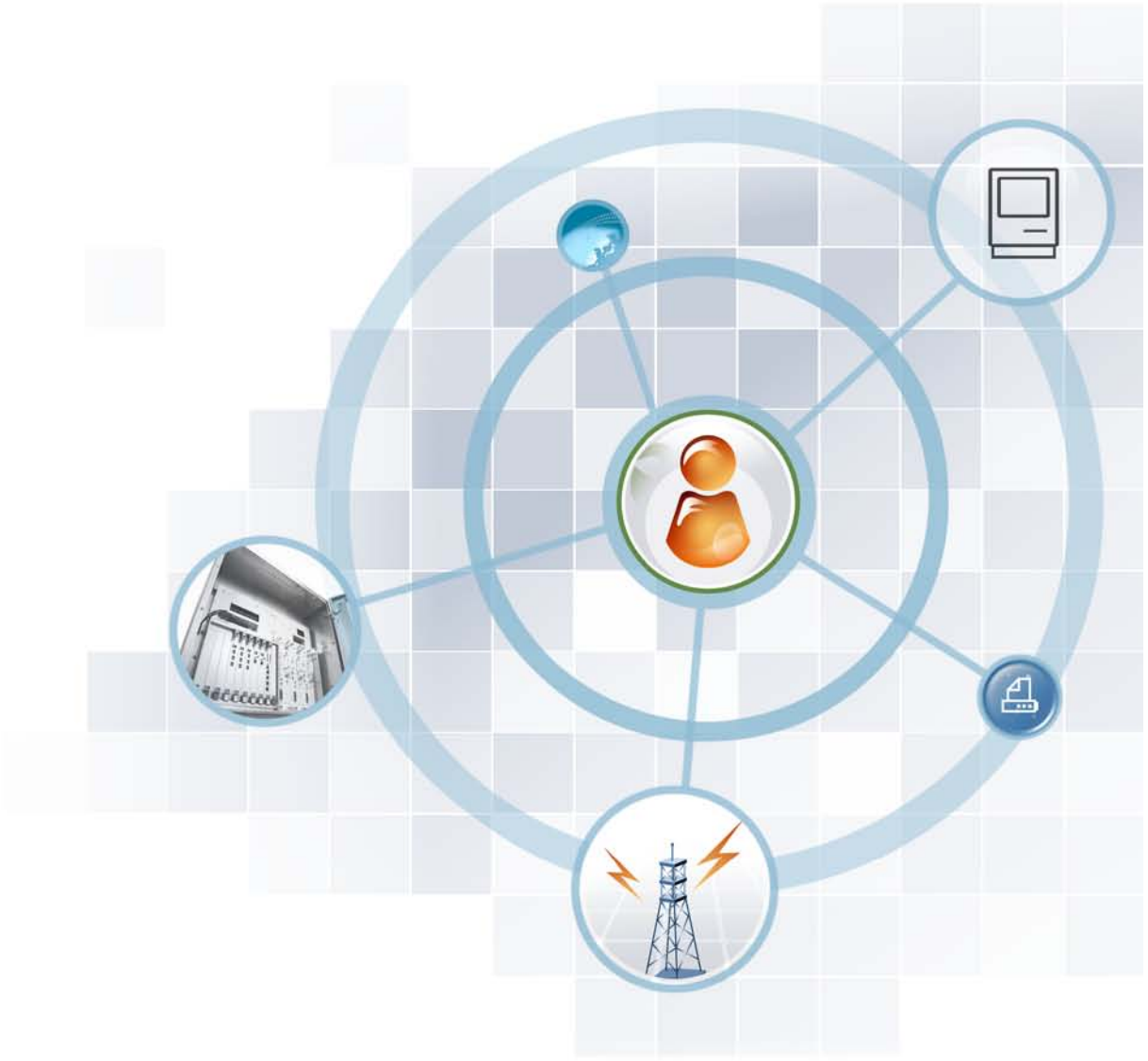
2600-00CTEIGAA Ver. 4.0

Smart MBS RRH-P4

Installation Manual



SAMSUNG ELECTRONICS

COPYRIGHT

TRADEMARKS

This manual should be read and used as a guideline for properly installing and operating the product.

This manual may be changed for the system improvement, standardization and other technical reasons without prior notice.

If you need updated manuals or have any questions concerning the contents of the manuals, contact our **Document Center** at the following address or Web site:

Address: Document Center 3rd Floor Jeong-bo-tong-sin-dong. Dong-Suwon P.O. Box 105, 416, Maetan-3dong Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 442-600

Homepage: http://www.samsungdocs.com

INTRODUCTION

Purpose

This manual describes procedure and method for installing Smart MBS RRH-P4.

Document Content and Organization

This manual consists of 2 Chapters, 6 Annex and Abbreviation as follows:

CHAPTER 1. Before Installation

This chapter introduces safety rules that must be understood for installing RRH-P4 and describes the configuration of RRH-P4.

CHAPTER 2. Installation of RRH-P4

This chapter describes the procedure to install RRH-P4.

ANNEX A. Sector Antenna Installation

This annex describes sector antenna configurations and its installation requirements.

ANNEX B. Feeder Line Work

This annex describes cautions and allowed radius of curvature when installing feeder line.

ANNEX C. Assembling connector

This annex describes the procedure of assembling connector.

ANNEX D. Cleaning Optic Connector

This annex describes the procedure of cleaning the optic connector and cleaning tool.

ANNEX E. Pressure Terminal Assembly

This annex describes the procedure of assembling the pressure terminal.

ANNEX F. Standard Torque

This annex describes the standard torque when assembling the fixing materials.

ABBREVIATION

Describes the acronyms used in this manual.

Conventions

The following types of paragraphs contain special information that must be carefully read and thoroughly understood. Such information may or may not be enclosed in a rectangular box, separating it from the main text, but is always preceded by an icon and/or a bold title.

WARNING

Provides information or instructions that the reader should follow in order to avoid personal injury or fatality.

CAUTION

Provides information or instructions that the reader should follow in order to avoid a service failure or damage to the system.

CHECKPOINT

Provides the operator with checkpoints for stable system operation.

NOTE

Indicates additional information as a reference.

Revision History

VERSION	DATE OF ISSUE	REMARKS
4.0	11. 2012.	* Added 2.8.5 Hybrid Cable Shield Grounding Connection * Modified - Figure 1.3 Cabling Diagram - Table 1.1 System Cabling - Table 1.3 Basic Installation Tools - Figure 2.7 Checking and Assembling Unused Cable Gland - Figure 2.15 Connecting RET cable - Figure 2.16 RET Cable connector - Table 2.3 RET Cable-Side Connector Pin Map - Figure 2.24 Connecting Hybrid cable (2) - Figure 2.26 Connecting Hybrid cable (4) - 2.8.3 Connecting RRH-P4 Power Cable - 2.8.4 Connecting RRH-P4 CPRI cable-Power Window
3.0	02. 2012.	- Added 2.4 Cable Gland Assembly and Cable Installation - Modified Figure 2.25 Connecting Hybrid cable (3)
2.0	09. 2011.	- Added caution-‘Managing unused port’ (2.7.2Connecting DU Cabinet side cable) - Added power cables (AWG8, AWG10), torque (2.7.3 Connecting RRH-P4 Power Cable) - Modified RRH-P4 Mounting Bracket configuration - Modified power SPD configuration. - Modified power cable, installation method - Modified Hybrid Cable installation method - Added CPRI cable connection standard (UADU~RRH-P4)
1.0	06. 2011.	First Edition

This page is intentionally left blank.

SAFETY CONCERNS

The purpose of the Safety Concerns section is to ensure the safety of users and prevent property damage. Please read this document carefully for proper use.

Symbols

Caution

Indication of a general caution

Restriction

Indication for prohibiting an action for a product

Instruction

Indication for commanding a specifically required action

WARNING

Power and Grounding

Watches, Rings, and Other Metallic Accessories

Do not wear accessories such as watches and rings in order to prevent electrical shock.

Connecting Ground Cable

In cabling, the connection of cables without the connection to the ground cable may cause the damage of the equipment or the bodily injury of the worker. Connect the ground cable first.

Caution When Opening and Closing Power Window Cover

Make sure to turn off the breaker connected to the RRH-P4 power before opening or closing the power window cover of the RRH-P4.

If you open or close the power window cover when the breaker is turned on, it may cause damage to the system, or cause an electric short circuit resulting in severe injury.

Installation General

Caution for Laser Beam of Optical Module and Cable

The optical module and cable used in the system emit bright laser beams. Always handle them with care as there is risk of serious injury if the eyes are exposed to the laser beam of the optical cable.

Wearing protection gloves and goggles

Make sure to wear protection gloves and goggles to prevent damages from debris while drilling holes in a wall or ceiling.

CAUTION

Power and Feeder line

Caution for cleaning the Power Supply

While cleaning the power supply device, take caution that the device does not come in contact with alien bodies that may cause power failure.

Caution for installing the power cable

To maintain cable gland's rain protection performance, 11.81 in. (300 mm) or more interval should be kept straight. According to the radius of curvature of the cable specification should be considered.

Caution for cutting the power cable

Cut power cable after installing power cable to RRH-P4 power terminal taking into account the radius of curvature according to the cable specifications.

When cutting the cable first, the length difference of cable end can be occurred by cable curvature and the power terminal may cause contact fault.

Caution When Connecting Optical Cables

Before connecting an optical cable, make sure that there is no dust or foreign substance on the cross-section of the connector core. If there is any dust or foreign substance, do not remove it by blowing with your mouth. Remove the dust or foreign substance by referring to the method of cleaning optic connector.

Caution on Rain-proof Gasket Damage When Installing Window Cover

Be careful so as not to let the rain-proof gasket get damaged (broken or incorrectly positioned). Check whether the rain-proof gasket is damaged before closing the power window cover and the optic window cover.

If the rain-proof gasket is damaged, replace the system (RRH-P4) with a new one.

Radius of Curvature of Feeder Line

When installing a feeder line, the radius of curvature of the sections where cables bent should be larger than the allowed radius of curvature. If the radius of curvature for the feeder line installation is less than the allowed radius of curvature, it may affect the performance of the system.

Connection of Feeder Cable Connector

Connecting the feeder cable connector is critical process, so the qualified workers who finished the related education should perform.

Caution When Connecting RET Cable

Make sure to turn off the breaker connected to the RRH-P4 power of the DU cabinet before connecting the RET cable between the antenna RET port and the RRH-P4 RET port.

If you connect or disconnect the RET cable while the breaker is turned on, it may cause an electric short circuit resulting in damage to the RET function.

Installation General

Caution when losing External Power Cable Support Bracket (‘2.6 Connecting ground cable’)

External Power Cable Support Bracket and two cable tie (stainless steel) for fixing cable are enclosed in RRH-P4 package. Be careful not to lose when unpacking package.

Managing unused port

Finish unused port of UADU by dust-cap, not making the alien substance flowed.

Finishing Cable Insertion Hole

Finishing work is required on cable insertion holes (Cable gland, Conduit and etc.) to prevent entering of any foreign substance, external air and moisture.

- Unused cable insertion hole: Finish cable insertion hole using fishing materials such as dust cap, rubber packing and etc.
- Cable-installed insertion hole: After installing cable, finish insertion hole using tape, compressed sponge, rubber packing, silicon, etc. to prevent empty space.

Caution when assembling the cable gland

Ensure that all parts of the cable gland are assembled in the correct sequence. Incorrect assembly may result in influx of external air or moisture into the system and may cause corrosion, system malfunction and/or critical failure of the cooling system.

Caution when installing the cable in the cable gland

Only one cable of permitted specification (radius) should be installed in the cable gland.

- Installing a cable of smaller radius than the permitted specification may result in influx of external air or moisture into the system and may cause corrosion or system malfunction.
- Installing a cable thicker than the permitted specification or installing two or more cables in the gland may damage the gland.

Caution when loosen and tighten the Cable Gland Nut

In case of assembling the cable gland and cabling, do not loosen and tighten by turning the cable gland body or other parts. turning the cable gland body may cause corrosion and system failure by entering of any external air and moisture.

Checking assembly state of the unused cable gland

All components of the unused cable gland must be secured in the original factory configuration. If the cable gland nut is fitted without the rain protection filler or the protection cover in place, reassemble them as illustrated in ‘Figure 2.7.’

Do not work by yourself

Do not work by yourself in any key process.

Caution for cleaning the Rack

Make sure that worker does not damage installed cables while cleaning the rack.

Cautions When Connecting the CRPI Cable

Failure to observe the CPRI cable connection specified in Table 2.5 may impair the communication between the CDMA and LTE FDD terminal.

RRH-P4 optic cable connection standard

Cable connection standard between UADU CPRI port and RRH-P4 optic port is different according to the count (One or two) of CDMA UADU (Installed in DU cabinet).

Connect the optic cable (Refer to the connection standard of ‘table 2.6’ and ‘table 2.7’). Because false connection can cause the fault of call connection, be cautious.

Caution when Installing the RF antenna

To protect from lightning, the RF antenna must be installed within the shielding angle as shown below, considering the downward distance and the angle from the tower lightning rod or the antenna pole lightning rod.

- The protection angle of the lightning rod should be 45 degrees.

Finishing Heat Shrink Tube of a Sector Antenna

1) Insert an antenna protection plate.
2) Place the heat shrink tube on the connection point and shrink the heat shrink tube using a heat gun.
3) Avoid aiming the heating gun toward the antenna’s body.

California USA Only

This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California USA ‘Perchlorate Material-special handling may apply, See www.dtsc.ca.gov/hazardouswaste/perchlorate.’

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1. Before Installation

1.1 System Configuration

RRH-P4 Configuration

The following shows the configuration of RRH-P4.

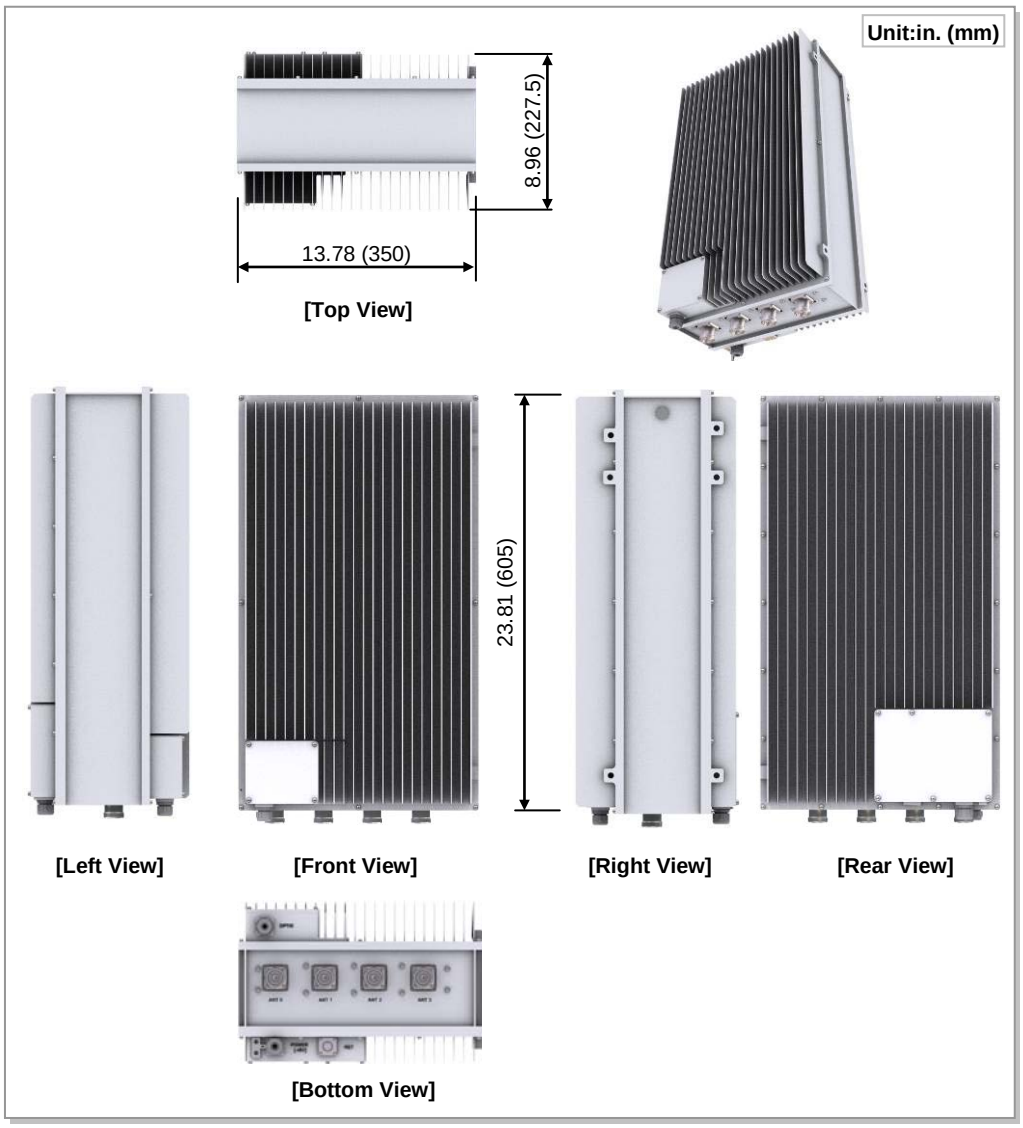


Figure 1.1 RRH-P4 Configuration

External Interfaces of RRH-P4

The following shows the external interfaces of RRH-P4.

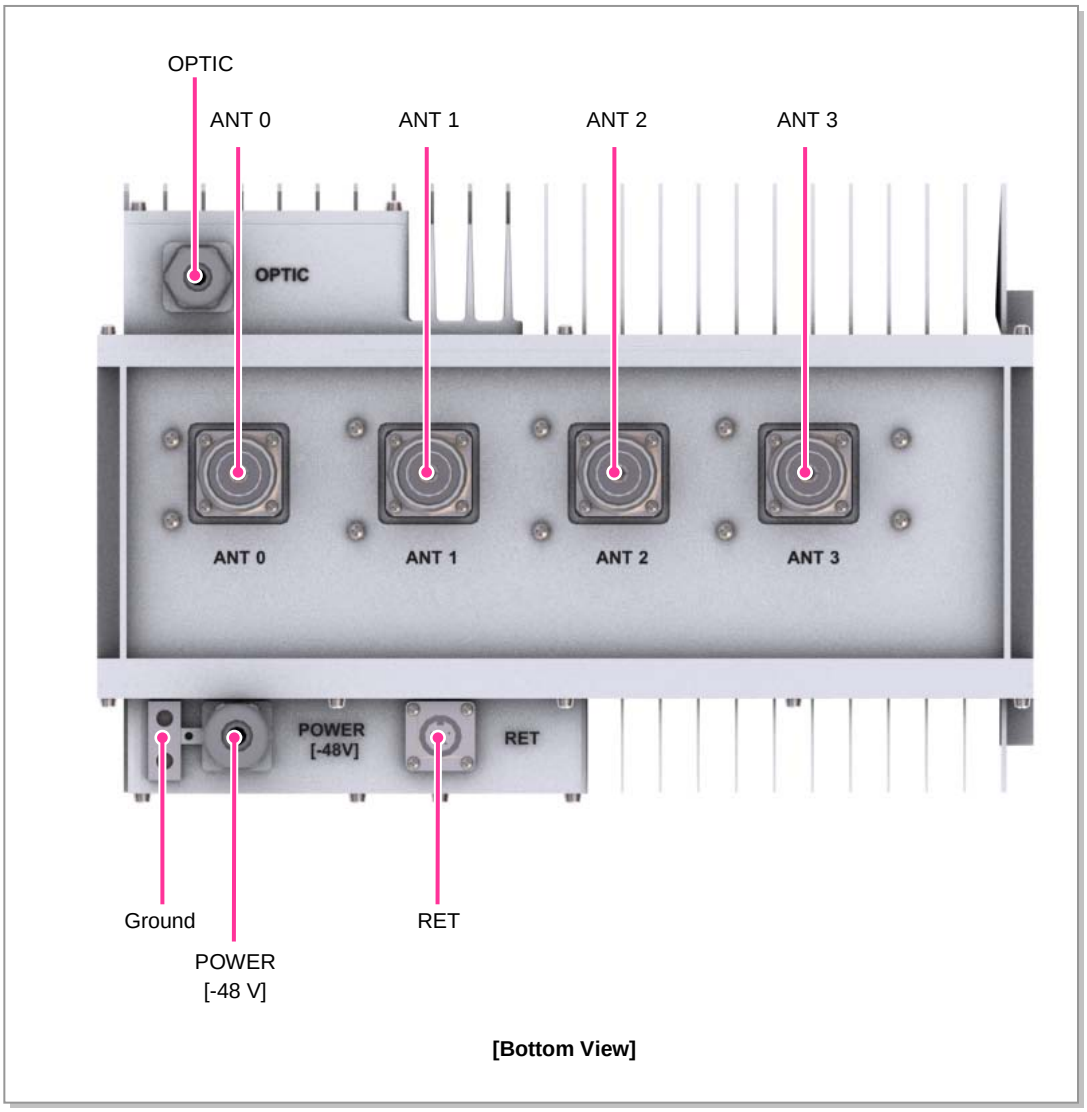


Figure 1.2 External Interfaces of RRH-P4

1.2 Specifications

Capacity

The following table shows the specifications for RRH-P4.

Item	Specifications
Air specification	CDMA/LTE FDD
Operating Frequency	- DL: 1930~1995 MHz - UL: 1850~1915 MHz
Channel Bandwidth	- CDMA: 1.25 MHz - LTE FDD: 5 MHz/10 MHz
Capacity	- CDMA: Max. 8 Carrier - LTE FDD: Max. 4 Carrier @ 5 MHz
RF Power per Sector [a)]	40 W × 4Tx (Total 160 W)
Multiple Antenna	- CDMA: 1T2R/2T2R/1T4R/2T4R - LTE: 2T4R/4T4R
DU~RRH-P4 Interface	2.5 Gbps, CPRI 4.0 (Optic)

a) Output power at the RU antenna port. (Not external filter antenna port)

Input Power

The following table shows the power specifications for RRH-P4. RRH-P4 complies with UL60950 safety standard for electrical equipment.

Item	Specifications
Input voltage	-48 V DC: -40~-56 V DC
Current consumption	20.3 A

Unit Size and Weight

The following table shows the size and weight of RRH-P4.

Item	Specifications
Size (W × D × H)	13.78 × 8.96 × 23.81 (in.) 350 × 227.5 × 605 (mm)
Weight	59.52 lb (27 kg) or less

Ambient Conditions

This section describes the operating temperature, humidity level and other ambient conditions and related standard of RRH-P4.
The following table shows the ambient conditions and related standard of RRH-P4.

Item	Range
Temperature[a)]	-40~131°F (-40~55°C) without solar load
Humidity[a)]	10~95 % The moisture content must not exceed 0.024 kg per 1 kg of air.
Altitude	0~1800 m (0~6000 ft)
Vibration	GR-63-CORE Sec.4.4 Earthquake Office Vibration Transportation Vibration
Noise (sound pressure level)	Max. 65 dBA at distance of 5 ft (1.5 m) and height of 3 ft (1.0 m)
Electromagnetic compatibility (EMC)	FCC Title47 Part 15 Class B
US Federal Regulation	FCC Title47 Part27

a) Temperature and humidity are measured at 59 in. (1.5 m) above the floor and at 15.8 in. (400 mm) away from the front panel of the RRH-P4.

1.3 Cabling

The following shows the cables connected to RRH-P4.

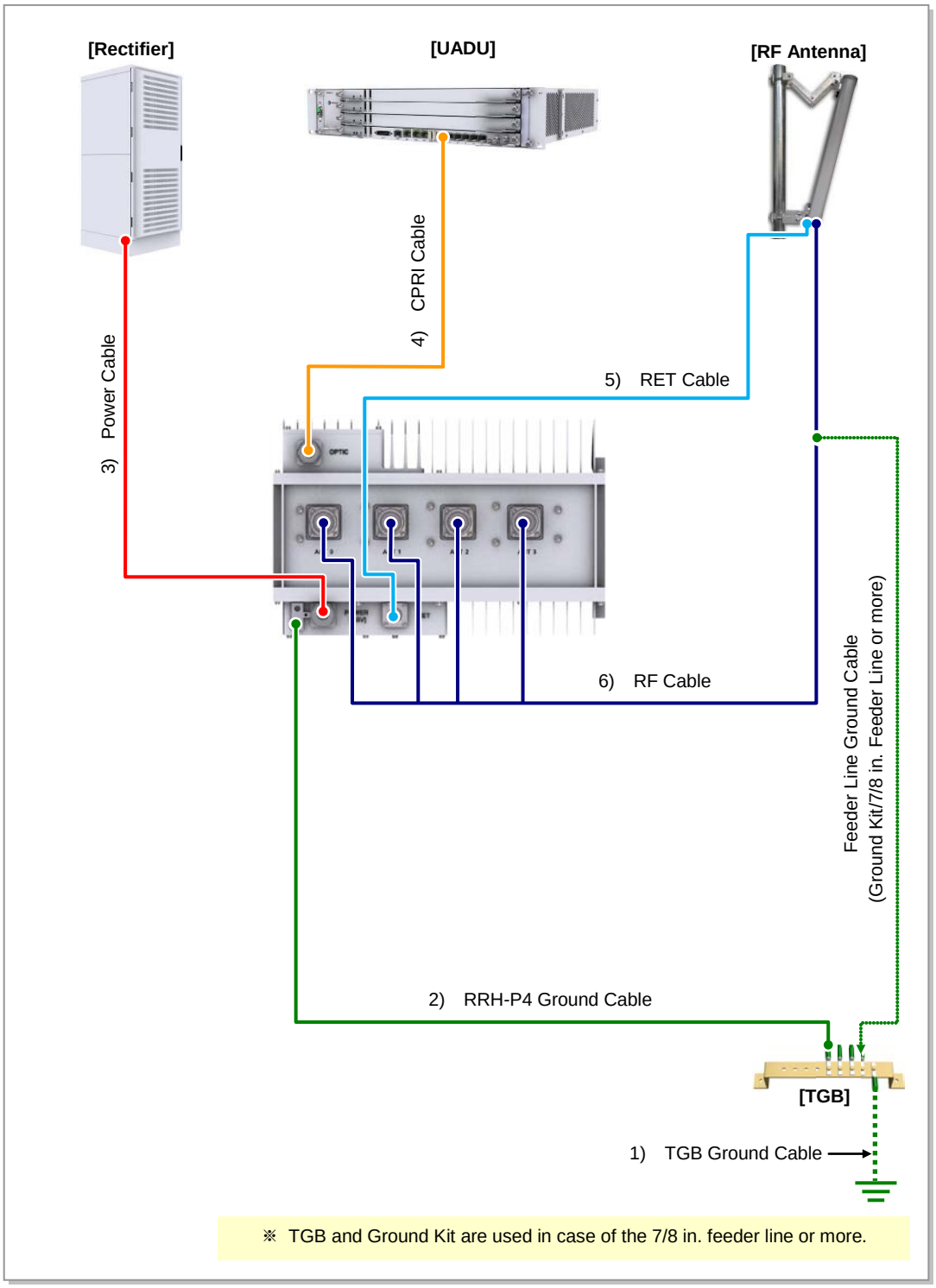


Figure 1.3 Cabling Diagram

Table 1.1 System Cabling

From	To	Cable
Underground Ground	TGB (Tower Ground Bar)	1) TGB Ground Cable : AWG2, GV 25 mm^2 × 1C (However, This can be different, defending on the standard of service provider)
RRH-P4	MGB	2) RRH-P4 Ground Cable : AWG8, GV 6 mm^2 × 1C
	Rectifier	3) Power Cable : AWG10, 4 mm^2 × 2C (or AWG8,6 mm^2 × 2C)
	UADU	4) CPRI Cable : Optic Cable (Single Mode)
	RET	5) RET Cable Ass'y (Shield Cable)
	Antenna	6) RF Cable : 1/2 in. or 7/8 in. Feeder Line

1.4 Installation Precaution

The following precaution must be observed to prevent accidents during RRH-P4 installation.

Before Installation

- Install a high voltage warning sign near the area where high voltage cable is located.
- Install a restricted entry warning sign near the potential accident area.
- Cover exposed areas such as junctions, ceilings, footholds etc. with safety rails or fence off the area.
- Study use of the fire alarm and the location of the fire extinguisher and how to use it.
- Check the location of the nearest emergency exit.

During Installation

- Cut all equipment power before installation.
- Always wear protection gloves and goggles when drilling holes into the wall or ceiling. To prevent electric shocks from metallic objects, remove all accessories such as watches or rings.

Wearing protection gloves and goggles

Make sure to wear protection gloves and goggles to prevent damages from debris while drilling holes in a wall or ceiling.

Watches, Rings, and Other Metallic Accessories

Do not wear accessories such as watches and rings in order to prevent electrical shock.

Do not work by yourself

Do not work by yourself in any key process.

Cable Path Inspection

When installing a cable that connects between the rectifier, Main Ground Bar (MGB), and backhaul device, etc. within the system, the cable path length and the cable installation method, etc. must be inspected.

Follow these guidelines when inspecting the cabling path.

- A minimum cable length must be selected provided that it does not affect the cable installation and maintenance.
- The cable must be placed in a location where it will not be damaged by external factors. (Power line, flooding, footpaths, etc.)
- In areas where the cable can be damaged by external factors, ensure that measures are taken to prevent damages to the cable. (Cable tray, ducts, flexible pipe, etc.)

Cable Cutting

Measure the exact distance, carefully checking the route, and cut the cable using a cutting tool.

Follow these guidelines when cutting the cable.

- Cut the cable to the length determined in the Cable Path Inspection step.
- Use a dedicated cable cutting tool.
- Cut the cable at right angles.
- Be careful to keep the cable away from any moisture, iron, lead, dust or other foreign material when cutting. Remove any foreign material attached to the cable using solvent and a brush.

Cable Installation

Cable installation involves running the cable along the cabling path to the target connector of the system or an auxiliary device after cable path inspection and cable cutting have been completed.

Follow these guidelines when installing a cable.

- Be careful not to damage the cable.
- If the cable is damaged, cut out the damaged section before installing.
- Run the cable so that it is not tangled. In particular, when installing a cable from a horizontal section to a vertical section, be careful not to reverse the upper and lower lines of the cable.
- Always use the maximum curvature radius possible, and make sure that the minimum curvature radius specification is complied with.
- If the cable needs to be protected, use a PVC channel, spiral sleeve, flexible pipe, and cable rack, etc.

Table 1.2 Minimum Allowed Cable Bend Radius

No	Type		Min. Allowed Cable Bend Radius	Remarks
1	GV/CV/FR-8		8 times of the cable external diameter	0.6/1 KV cable
2	Optic Cable		20 times of the cable external diameter	-
3	UTP/FTP/S-FTP Cable		4 times of the cable external diameter	PVC/LSZH, 4 Pair
4	1/2 in. Feeder Line (Indoor)		1.26 in. (32 mm)	RFS, LS
5	1/2 in. Feeder Line (Outdoor)		4.92 in. (125 mm)	RFS, LS
6	7/8 in. Feeder Line (Outdoor)		9.84 in. (250 mm)	RFS, LS
7	1 1/4 in. Feeder Line (Outdoor)		14.96 in. (380 mm)	RFS, LS
8	1 5/8 in. Feeder Line (Outdoor)		19.69 in. (500 mm)	RFS, LS
9	LMR-400		1 in. (25.4 mm)	Installation
			4 in. (101.6 mm)	Repeated
10	RG-316D		0.59 in. (15 mm)	-
11	Hybrid Cable	External diameter: 0.98 in. (25 mm)	11.81 in. (300 mm)	-
		External diameter: 1.06 in. (27 mm)	13.0 in. (330 mm)	-
		External diameter: 1.18 in. (30 mm)	15.35 in. (390 mm)	-
		External diameter: 1.26 in. (32 mm)	17.71 in. (450 mm)	-

* If the allowed cable bend radius is specified by the manufacturer, comply with the bend radius specified.

Cable Binding

Cable binding involves fixing and arranging an installed cable using binding strings, cable ties, binding lines, and ram clamps, etc.

Follow these guidelines when binding a cable.

- Be careful not to damage the cable during binding.
- Use appropriate cable binding tools according to the target location (indoor or outdoor, etc.) and the use of the cable (power supply cable, optical cable, feeder line, etc.).
- Do not let the cutting section of a cable tie and binding line, etc. be exposed to the outside. This may cause damage to cables or personal injury. Make sure that the cutting sections of cables are not exposed to the outside.
- Trim the binding string so that you have about 1.97 in. (5 cm) of string left from the knot. And insert the remaining string into the knot and make sure the knot does not loosen.
- If there is a potential danger of contact failure in a connector connection due to tension, install the cable in the shortest distance.

Connector Attachment

Connector attachment involves assembling a connector to an installed cable or to a device on the site.

Follow these guidelines when attaching a connector.

- Make sure you are fully aware of the connector assembly method before assembling a connector. Assemble the connector in accordance with its pin map.
- Each connector has a hook to prevent its core positions from being changed.
- Use a heat shrink tube at a connector connection for cables that are installed outdoor, such as feeder lines, to prevent water leakage and corrosion from occurring at the part exposed to the outside.
- Connect each cable of the connector assembly in a straight line.
- Be careful when connecting a cable not to trigger contact failure at a connector connection due to tension.

Identification Tag Attachment

Identification tag attachment involves attaching a marker cable tie, nameplate, and label, etc. to the both ends of a cable (connections to a connector) to identify its use and cabling path.

NOTE

Marker Cable Tie

On the marker cable tie, a label can be attached.
The appearance and specification may differ depending on the type and manufacturer.

Follow these guidelines when attaching an identification tag.

- When installing a cable outdoor, use relief engraving and coated labels, etc. to prevent markings from being erased.
- Since the form and attachment method for identification tags are different for each provider, consult with the provider before attaching them.

WARNING

Connecting Ground Cable

In cabling, the connection of cables without the connection to the ground cable may cause the damage of the equipment or the bodily injury of the worker. Connect the ground cable first.

CHECK

Cable Installation Checklist

When installing, take care not to overlap or tangle the cables; also, consider future expansion. Install the DC power cable and data transmission cable away from the AC power cable to prevent electromagnetic induction.

Cable Works

The cable works require knowledge for the cabling works such as cable installation/binding.

After Installation

- Cover the cable hole on the floor with a solid cover.
- Remove all installation residues; clean the area.

Caution for Laser Beam of Optical Module and Cable

The optical module and cable used in the system emit bright laser beams. Always handle them with care as there is risk of serious injury if the eyes are exposed to the laser beam of the optical cable.

Caution for cleaning the Rack

Make sure that worker does not damage installed cables while cleaning the rack.

Caution for cleaning the Power Supply

While cleaning the power supply device, take caution that the device does not come in contact with alien bodies that may cause power failure.

Damage Prevention

For handling devices sensitive to static electricity, be aware of the followings to avoid damages of various board elements.

- The board should be kept away from materials prone to static electricity such as plastic, acrylic plates, paper, Styrofoam etc.
- The board should be kept in a static electricity prevention storage box.

1.5 Installation Tool

The basic tools for installation are listed in the table below. The additional tools required for each installation procedure need to be identified and prepared before starting installation.

Table 1.3 Basic Installation Tools

No.	Name	Specification
1	Torque driver set	No.0~+ No.3 (M2.6~M6 '+' Driver) 0.07~4.34 lbf·ft (1.0~60 kgf.cm)
2	Torque wrench set	M6~M12 0.72~2.17 lbf·ft (10~30 kgf.cm), 7.23~36.15 lbf·ft (100~500 kgf.cm), Replaceable head
3	Torx Driver	T20
4	Nut driver set	0.24~0.39 in. (6~10 mm)
5	Hacksaw Frame/Blade	Normal/HIS
6	Level/Plumb bobs	Normal/1.10 lb (500g)
7	Heating gun	122~572°F (50~300°C)
8	Solder	30~130 W
9	Power extension cable	98.42 ft (30 m)
10	Tape measure	16.4 ft/164 ft (5 m/50 m)
11	Cable cutter	12.8 in. (325 mm)
12	Silicon gun/Silicon	Normal/Gray & Colorless
13	Spanner	0.75 in. 0.94 in. 1.42 in. (19 mm, 24 mm, 36 mm)
14	Hexagonal wrench bolt	-
15	Hoisting wire	82 ft (25 m)
16	Installation Tools for Stainless Steel Cable Ties	DAS-250 , ties up to 0.31 in. (7.9 mm) width straps.

Precautions for use of Installation Tools

The required installation tools may vary depending on the conditions at the site. In addition to the basic tools, a protractor, compass, GPS receiver, ladder, safety equipment, cleaning tools etc. should also be prepared in consideration of the site conditions.

CHAPTER 2. Installation of RRH-P4

2.1 Installation Procedure

The following diagram shows RRH-P4 installation procedure.

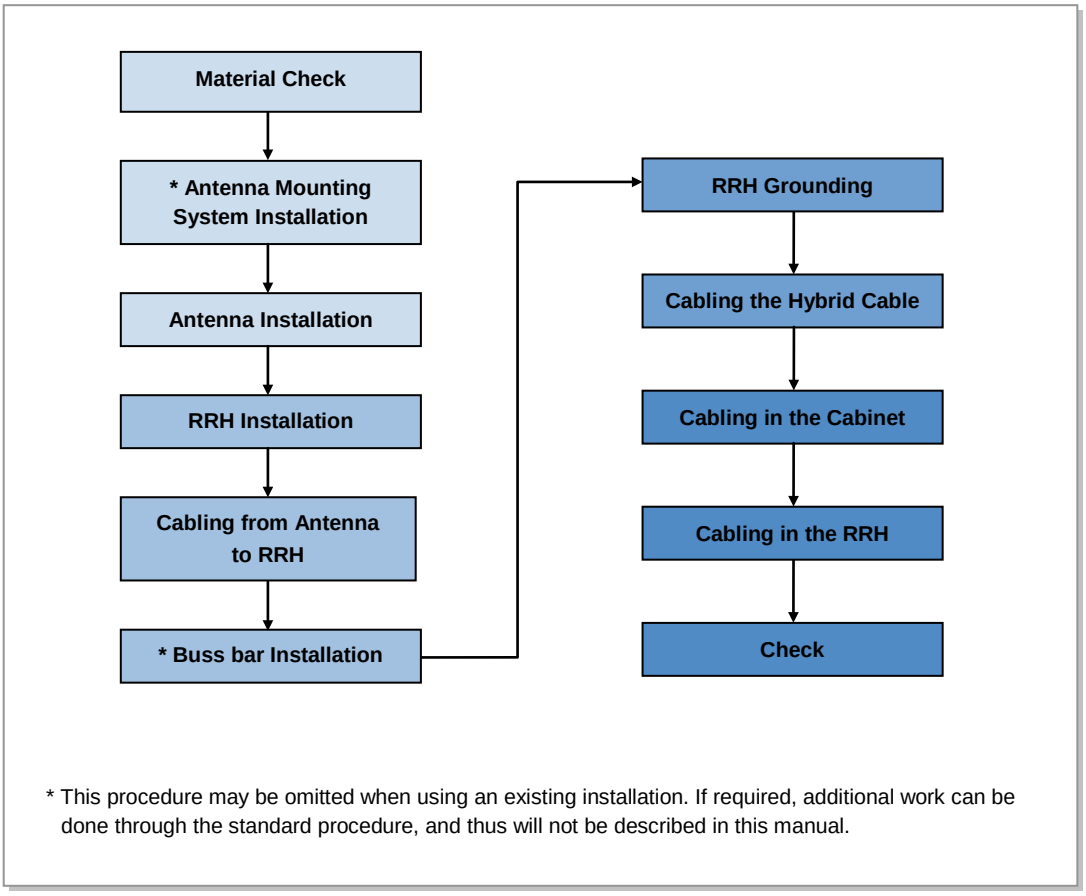


Figure 2.1 System Installation & Cable Connection Procedure

2.2 Foundation Work

2.2.1 Equipment Arrangement

A minimum distance must be secured around the RRH-P4 in each direction for installation and maintenance.

Table 2.1 Recommended Distances for System Arrangement

Item	Recommended Distances
Front/Rear	31.5 in. (800 mm) or more
Sides	23.62 in. (600 mm) or more

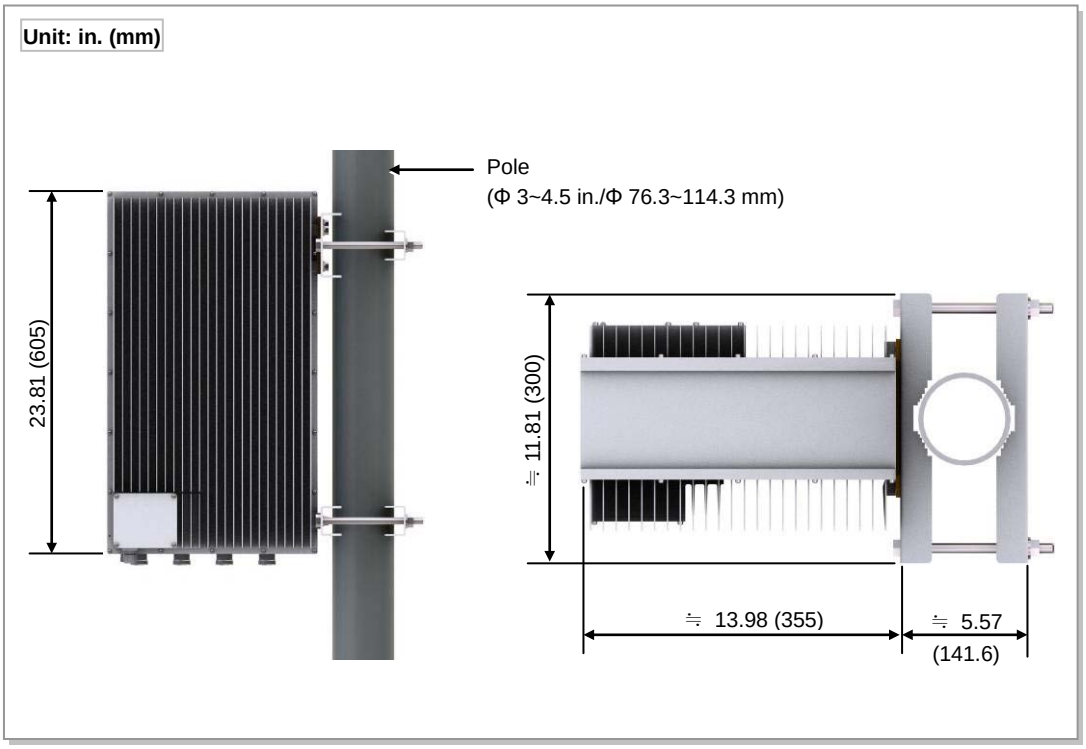


Figure 2.2 RRH-P4 Installation Space (1 sector pole type)

NOTE

Equipment Installation Space

The figure above illustrates the installation space using a 4 in. (101.6 mm)/90 A diameter pole. The measures may differ depending on the diameter of the pole.

2.3 Unpacking and Transporting

This paragraph describes the work to unpack cabinets and other components and transport them to the place to be installed. The cabinet is externally packed and cabinet and other components are individually packed.

- The external packing should be unpacked outside of the building. If necessary, it can be unpacked after transporting to the area near installation place.
- Transport the cabinet to the installation place. Be aware of the damage of walls, pillars, and bottom of the passage when transporting the cabinet.
- Transport other components with packing and sort by types.

2.3.1 Importing Items

To import items, be aware of the followings:

- Regarding equipment weight and size, check the path to bring the equipment.
- Lay Iron and veneer boards on stairs or doorsills to make the transportation easy.
- When bring in equipment, beware of damage or impairment of main entrance, walls, pillars, and floors of the station. Prepare protection materials and fix them with a high-strength adhesive.
- Carry boards in packing status, and unpack them when installing or mounting.

Vibration Level for Transportation

- When carrying the system, fasten the system firmly not to exceed the proper vibration level from 1 to 500 Hz.
- When carrying system, use a lift to prevent accidents. However, if the system should be carried by people, enough people are required to carry the system.
- Before moving the system, check the storage place for the system and remove obstacles in advance. While moving system, boards and other devices should not be shocked physically and damaged caused by dust, moisture, and static electricity.

When installing the items imported, abide by the following:

- System should be installed in a location whose access is not easy from outside.

2.3.2 Unpacking Items

The procedure to unpack items is as follows:

- The packing items should be packed until they reach the installation place.
- The items are classified in accordance with each job specification and stored on a place with no interference on working.
- Unpacked systems should be installed immediately. If not installed immediately, the systems should be stored in the installation place temporarily.
- Unpack the inner packaging after each system is placed on its installation location.
- Unpack the inner packaging after each system is placed on its installation location.
- Do not recycle the packaging waste. Dispose of them pursuant to the rules.

2.4 Cable Gland Assembly and Cable Installation

CAUTION

Caution when assembling the cable gland

Ensure that all parts of the cable gland are assembled in the correct sequence. Incorrect assembly may result in influx of external air or moisture into the system and may cause corrosion, system malfunction and/or critical failure of the cooling system.

CAUTION

Caution when installing the cable in the cable gland

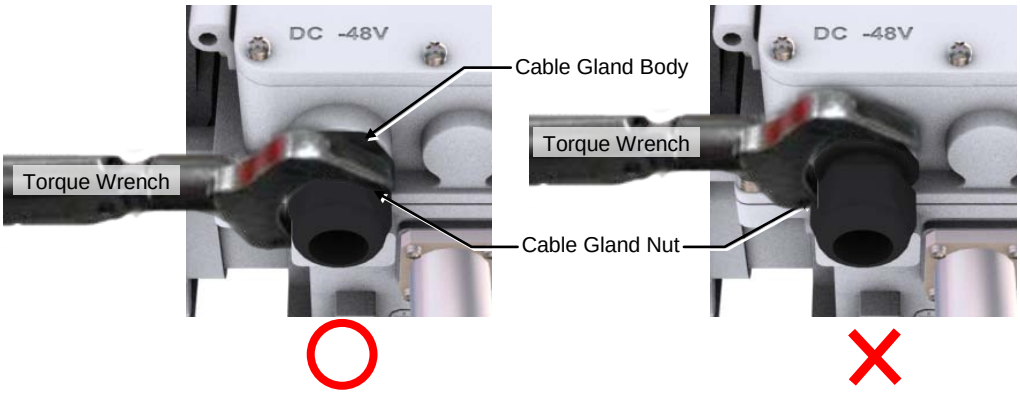
Only one cable of permitted specification (radius) should be installed in the cable gland.

- Installing a cable of smaller radius than the permitted specification may result in influx of external air or moisture into the system and may cause corrosion or system malfunction.
- Installing a cable thicker than the permitted specification or installing two or more cables in the gland may damage the gland.

CAUTION

Caution when loosen and tighten the Cable Gland Nut

In case of assembling the cable gland and cabling, do not loosen and tighten by turning the cable gland body or other parts. turning the cable gland body may cause corrosion and system failure by entering of any external air and moisture.



NOTE

Tighten the Cable Gland Nut by Using Torque Wrench

Cable gland nut should be tightened by using torque wrench and the torque value meets standard.

2.4.1 Cable Gland Parts

By loosening the gland nuts outside the unit, the cable gland is dissembled into 3 parts as shown in the picture below.
(Except for system-side fixing parts)

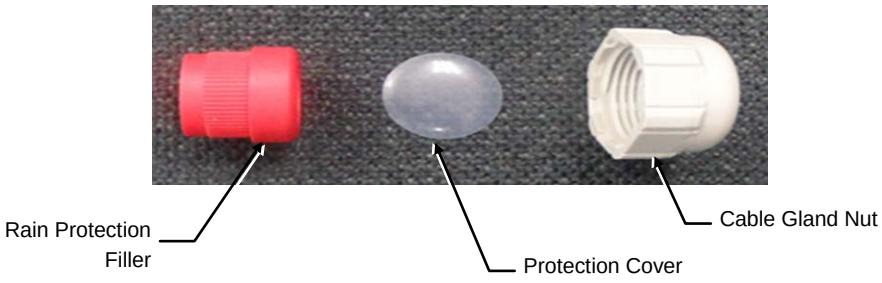


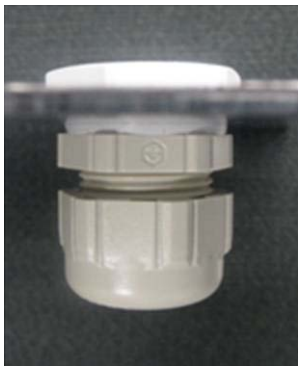
Figure 2.3 Cable Gland Parts

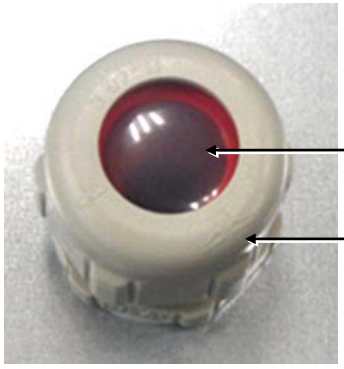
2.4.2 Cable Gland Assembly and Cabling Procedure

Follow the cable gland assembly instructions below to prevent influx of moisture and foreign substances.

1) Check the cable gland built on the unit whether it has the protection cover inside the cable gland nut as shown in the picture below (cross-section picture of outer wall of the unit), the same as the original factory configuration..

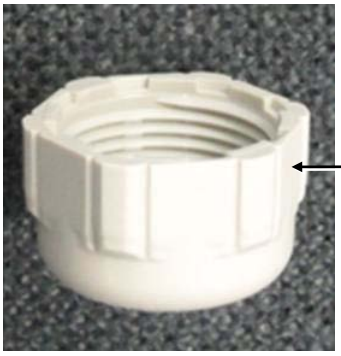
[Cross-section]





2) Separate the cable gland nut by loosening counterclockwise.
Here, check the protection cover (circular transparent plate).

[Loosened Cable Gland Nut]



3) Remove the protection cover (circular transparent plate) and keep it separately.

[Removed Protection Cover]

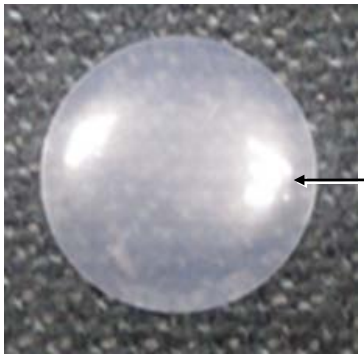
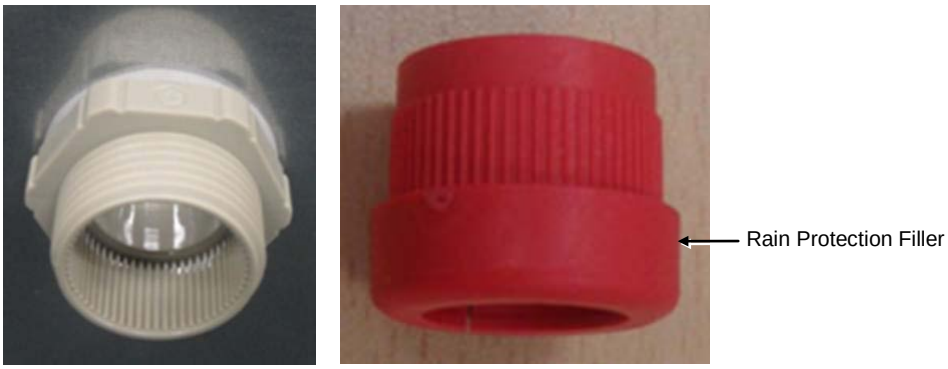


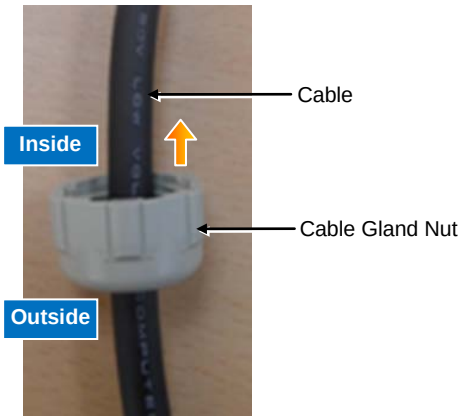
Figure 2.4 Cable Gland Assembly and Cable Installation Procedure (1)

4) Separate the rain protection filler from the cable gland body.

[Separated rain protection filler]



5) Install the cable by passing it through the cable gland nut from outside to inside.



6) After installing the cable through the cable gland body, connect it to the system according to assembling standard and clean up the rest of the cable.

7) Put the rain protection filler on the cable inside the cable gland nut.
At this time, widen the split groove of rain protection filler and wrap the cable around.

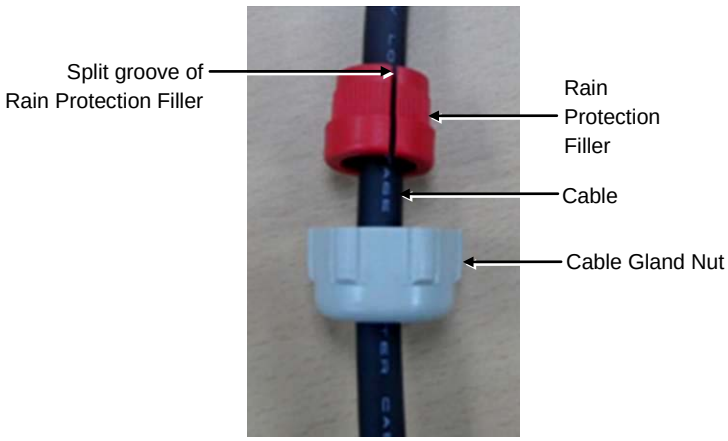
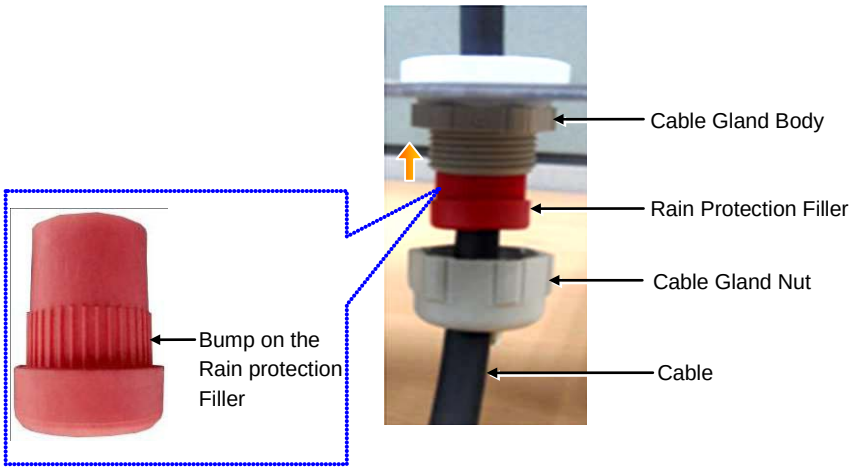
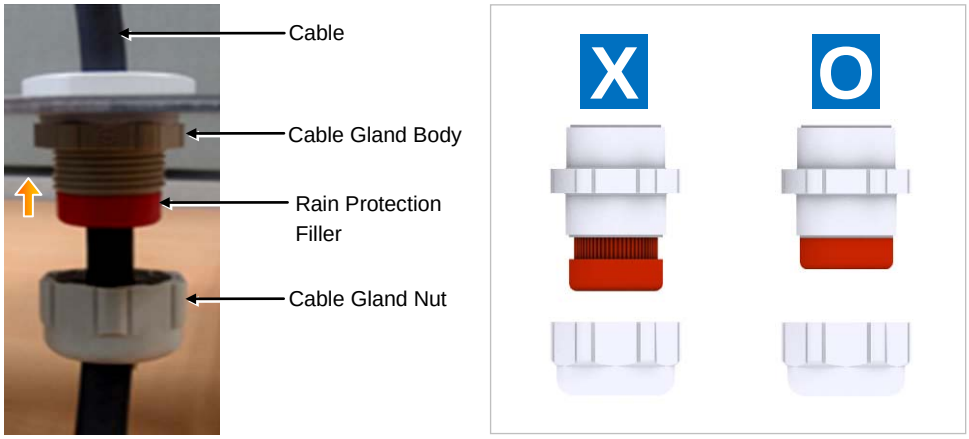


Figure 2.5 Cable Gland Assembly and Cable Installation Procedure (2)

8) Push the rain protection filler into the cable gland body.
(There are bumps inside the cable gland body and outside the rain protection filler to help easily fasten them and prevent them from rotating. Thus, place them in a right position to fit into each other.)



9) Attach the rain protection filler into the cable gland body as shown in the picture below. Make sure it is pushed in completely.



10) Attach the cable gland nut and the cable gland body together and fasten the nut clockwise.

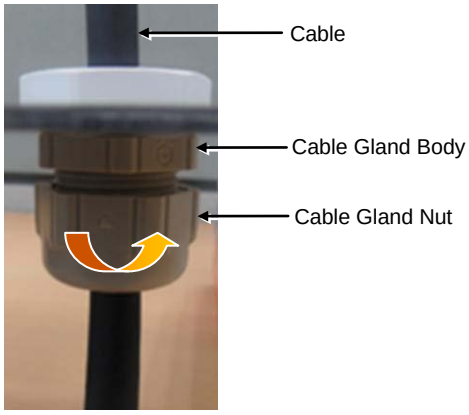


Figure 2.6 Cable Gland Assembly and Cable Installation Procedure (3)

2.4.3 Checking and Assembling Unused Cable Gland

Follow the instructions below to check and assemble the unused cable gland.

The unused cable gland should not be disassembled, and be kept in the original factory configuration.
If it is disassembled, it should be assembled in the same way as the original factory configuration based on 'cable gland parts configuration'.

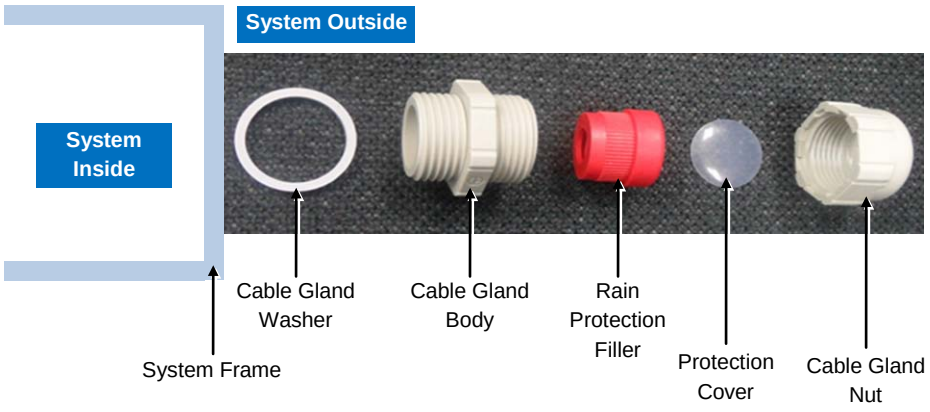


Figure 2.7 Checking and Assembling Unused Cable Gland

CAUTION

Checking assembly state of the unused cable gland

All components of the unused cable gland must be secured in the original factory configuration. If the cable gland nut is fitted without the rain protection filler or the protection cover in place, reassemble them as illustrated in 'Figure 2.7'.

2.5 Fixing the System

2.5.1 Fixing Wall Mount

Follow the steps below to fix the RRH-P4 to the wall.

1) Fix the top bracket and bottom bracket to the RRH-P4. (A~B)
2) Fix the RRH-P4 and bracket to the wall. (C)

A) Place the bakelite-top 1, 2 and top bracket to the RRH-P4's top fixing holes and fix these firmly with insulation bushing, spring washer, plane washer and M8 × 25L Hex. bolt.

B) Place the bakelite-bottom and bottom bracket to the RRH-P4's bottom fixing holes and fix these firmly with insulation bushing, spring washer, plane washer and M8 × 25L Hex. bolt.

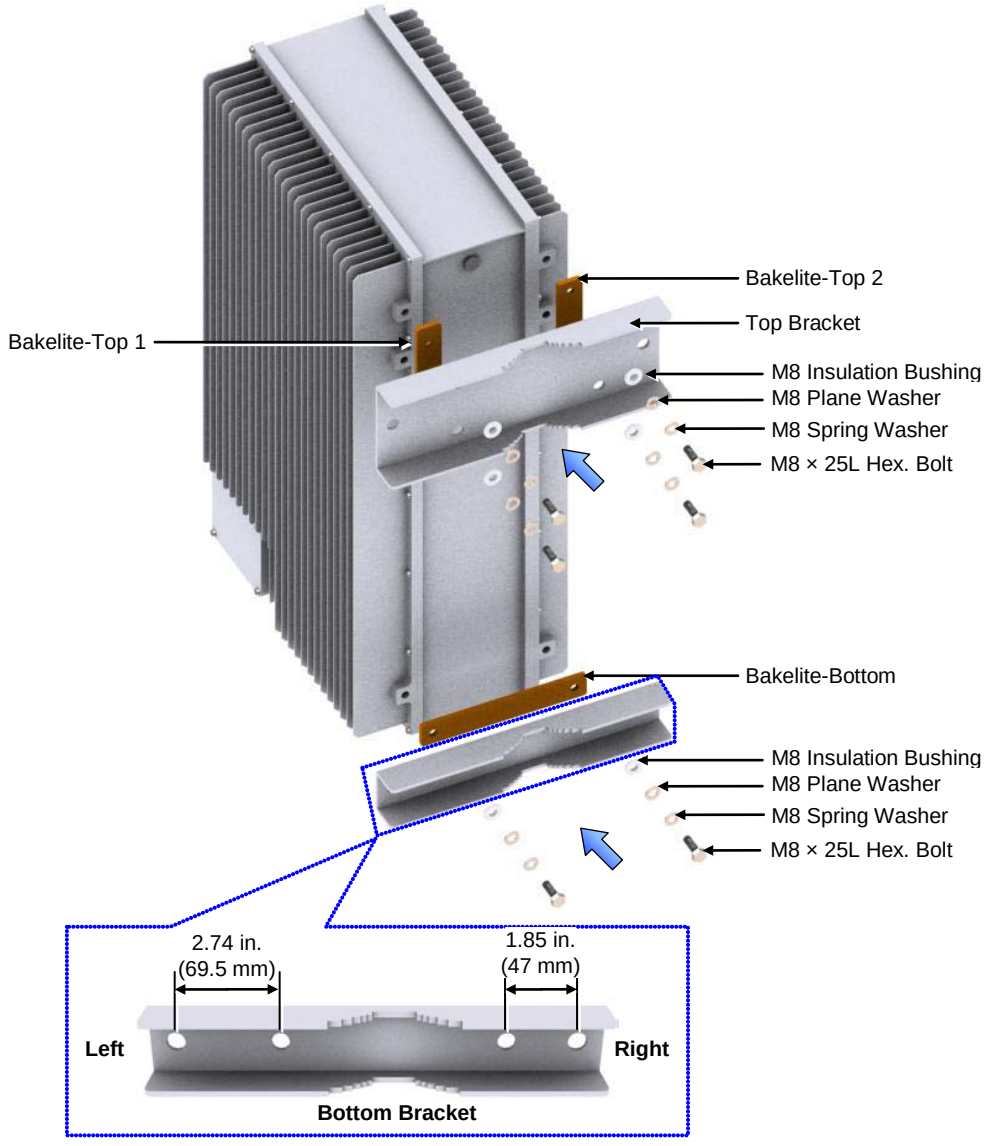


Figure 2.8 Fixing Wall Mount (1)

C) Fix top bracket and bottom bracket (Attached to the RRH-P4) to the wall with M10 anchor bolt ass'y.

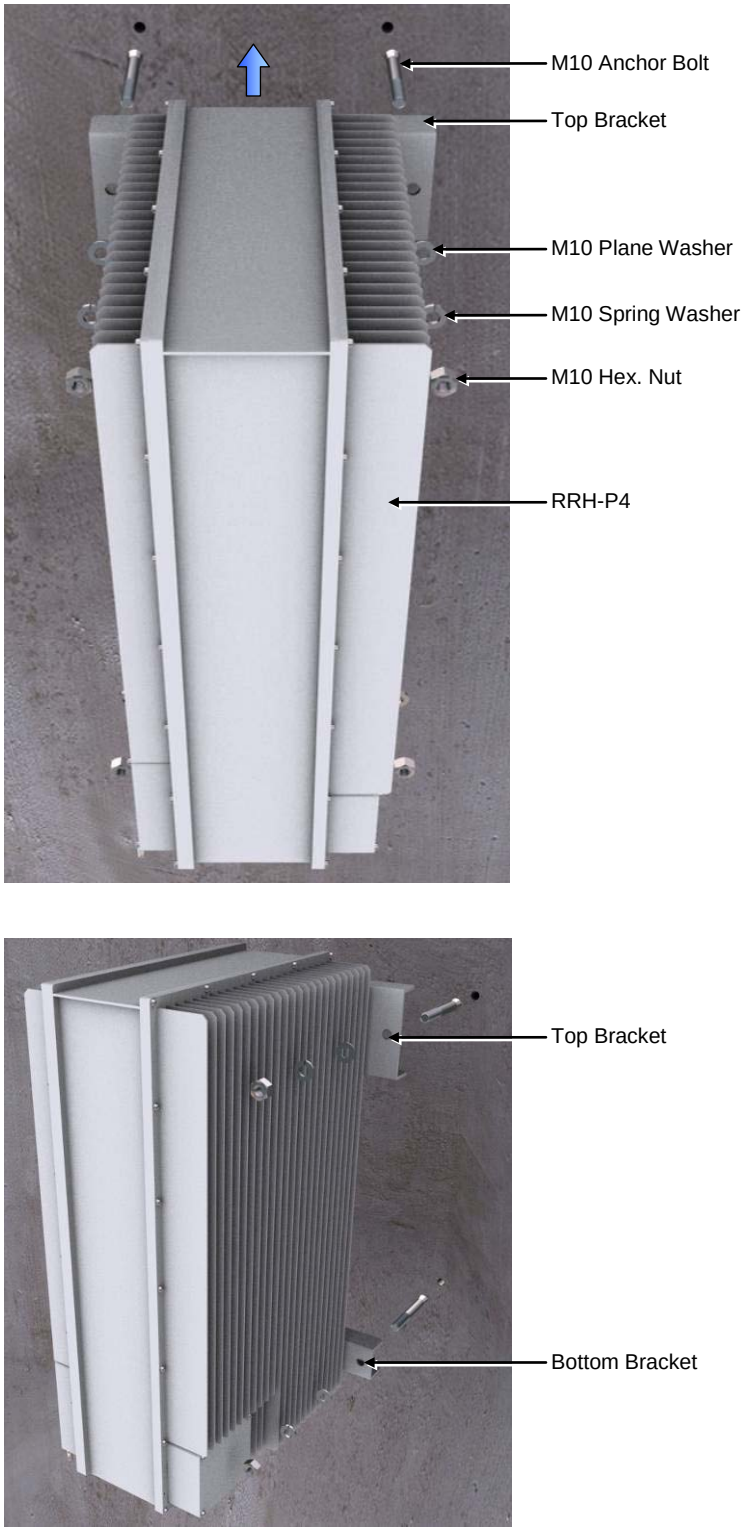


Figure 2.9 Fixing Wall Mount (2)

Cautions When Using Wall Mount Fasteners

The fasteners used to attach the wall mount, including the anchor bolt, spring washer, plane washer and Hex. nut must be made of stainless steel (STS 304). Otherwise, it may cause corrosion and rust to fixing materials.

2.5.2 Fixing 1 Sector Pole

Follow the steps below to fix the RRH-P4 to the pole.

1) Fix the top bracket and bottom bracket to the RRH-P4. (A~B)
2) Fix the RRH-P4 and bracket to the RRH-P4. (C)

A) Place the bakelite-top 1, 2 and top bracket to the RRH-P4's top fixing holes and fix these firmly with insulation bushing, spring washer, plane washer and M8 × 25L Hex. bolt.

B) Place the bakelite-bottom and bottom bracket to the RRH-P4's bottom fixing holes and fix these firmly with insulation bushing, spring washer, plane washer and M8 × 25L Hex. bolt.

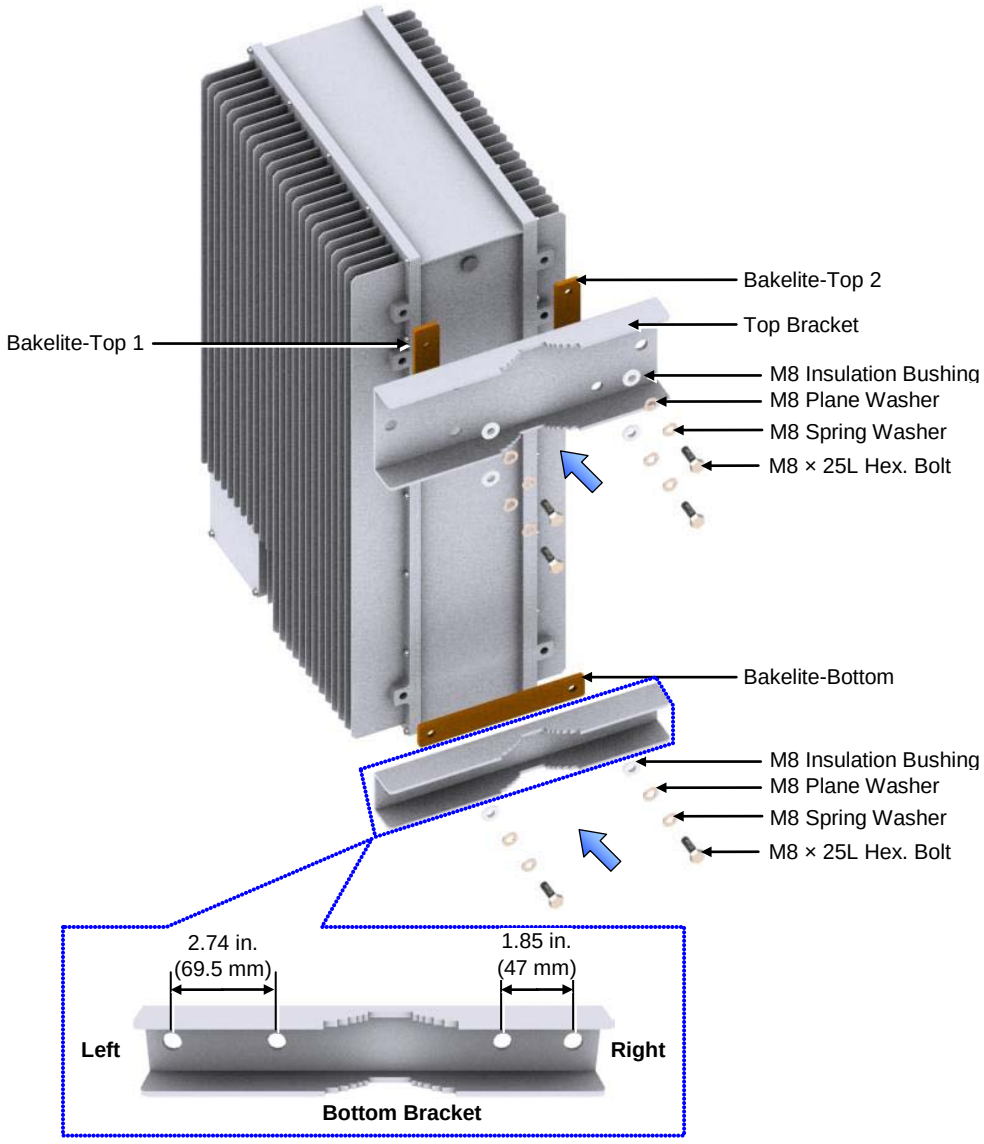


Figure 2.10 Fixing 1 sector pole (1)

C) Place the RRH-P4 (Attaching Top bracket and bottom bracket) to the pole front, place the rear bracket to the pole rear, and fix these firmly with insulation M12 × 180L Hex.bolt, plane washer, spring washer and Hex. nut.

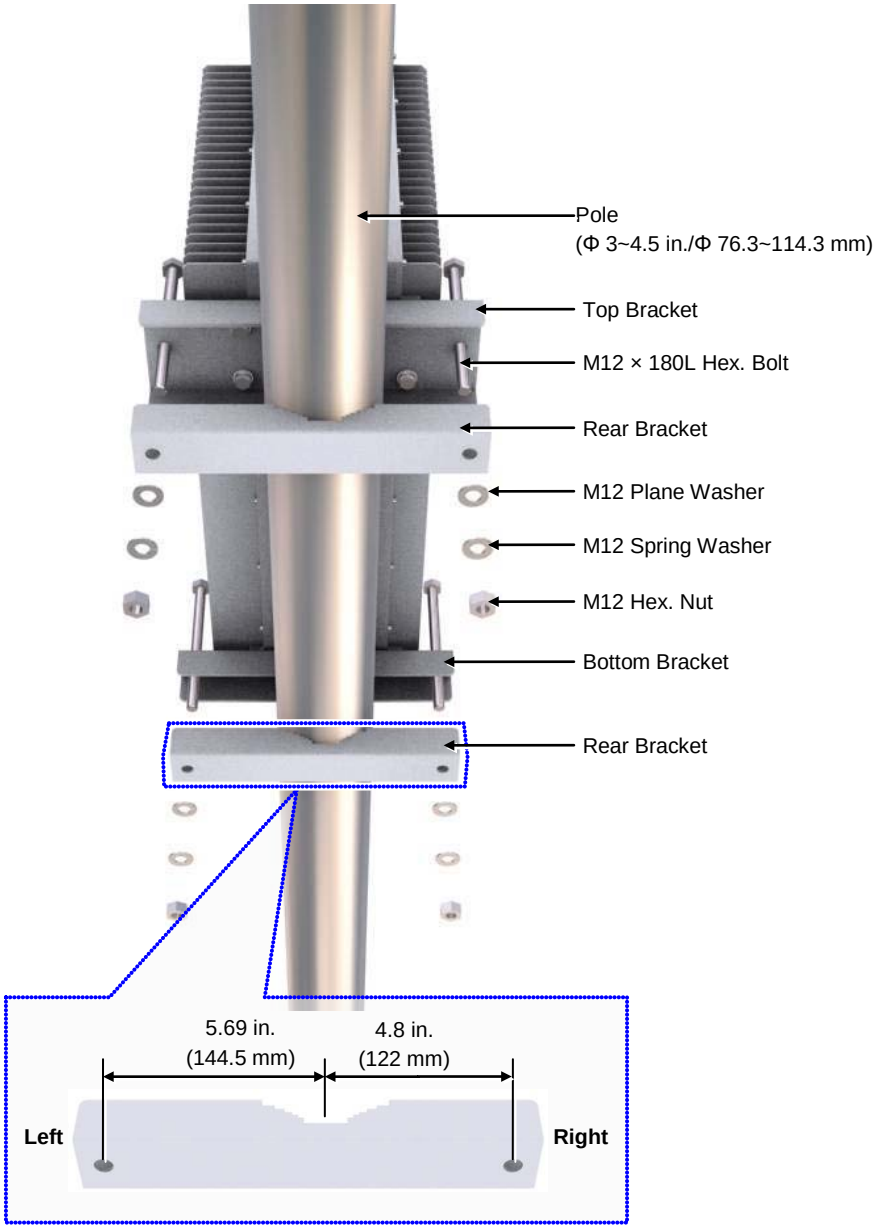


Figure 2.11 Fixing 1 sector pole (2)

CHECK

Cautions When Using Pole Fasteners

The fasteners used to attach the pole, including the hex. bolts, hex. nut, spring washers and plane washers must be made of stainless steel (STS 304). Otherwise, it may cause corrosion and rust to fixing materials.

CAUTION

Mounting Protection Cap on RRH-P4 Output Port

Make sure to mount a protection cap on the output ports (ANT 0-3) when you putting up or down the RRH-P4.

If you use the RRH-P4 without mounting a protection cap, it may cause damage to or scratches on the output port and affect the output performance of the RRH-P4.

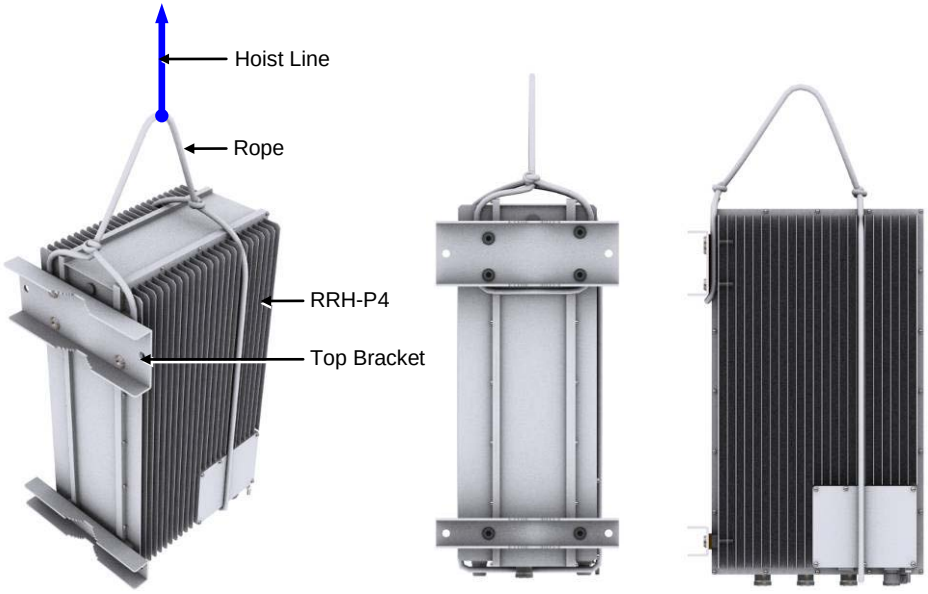
[Good: Protection Cap Mounted] **[Bad: Protection Cap Not Mounted]**

CHECK

How to lift up RRH-P4

After fixing the bracket of RRH-P4 side, bind the rope to the heat sink of RRH-P4 and a space between top bracket and RRH-P4, lift up using a hoist lift as shown below.

For the safety, maintain the status of lifting up by completing RRH-P4 installation. Unbind the rope after the installation is complete.



2.6 Connecting cable between RRH and Antenna

2.6.1 Connecting Feeder Line

Follows the steps below to connect the feeder line.

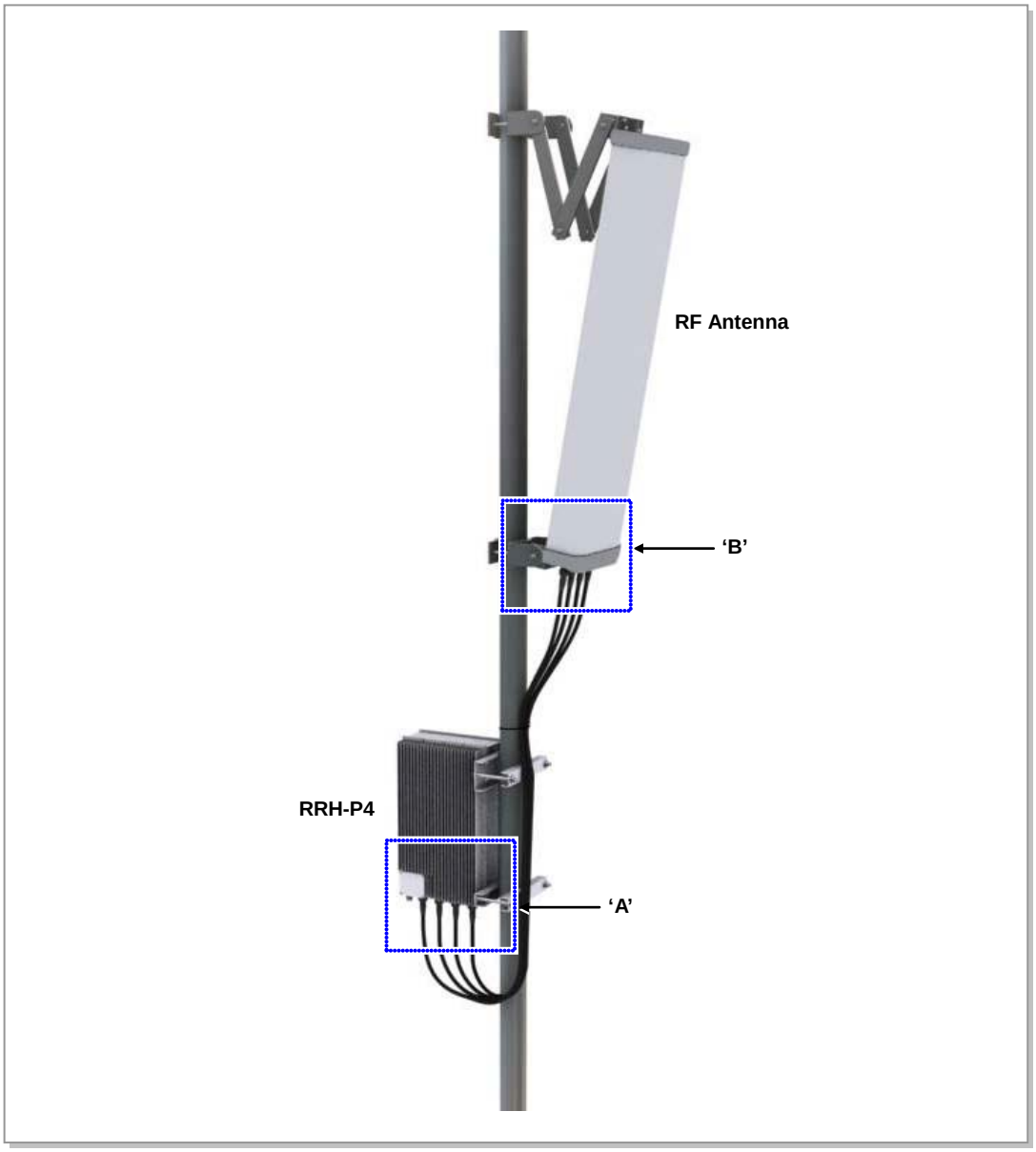


Figure 2.12 RRH-P4 Feeder Line Connection Diagram

CHECK

Caution for connecting and disconnecting Feeder Line Connector

- Check whether the system is turned off before connecting or disconnecting a feeder line connector to or from the RRH-P4 RF port and the RF antenna.
- When connecting the feeder line between RRH-P4 RF port and RF antenna, each port and the feeder line connector should be tighten by 14.46 lbf.ft (200 kgf.cm) torque to minimize influence of PIMD.

1) Install 1/2 inch feeders line from the RF port at the bottom of RRH-P4 to the RF antenna.
2) Insert a heat shrink tube (jelly type) to each end of the installed 1/2 inch feeder lines, then connect a Din type-male connectors to the RRH-P4's RF port and the RF antenna port.
3) After installing the connector, shrink the heat shrink tubes using a heat gun.

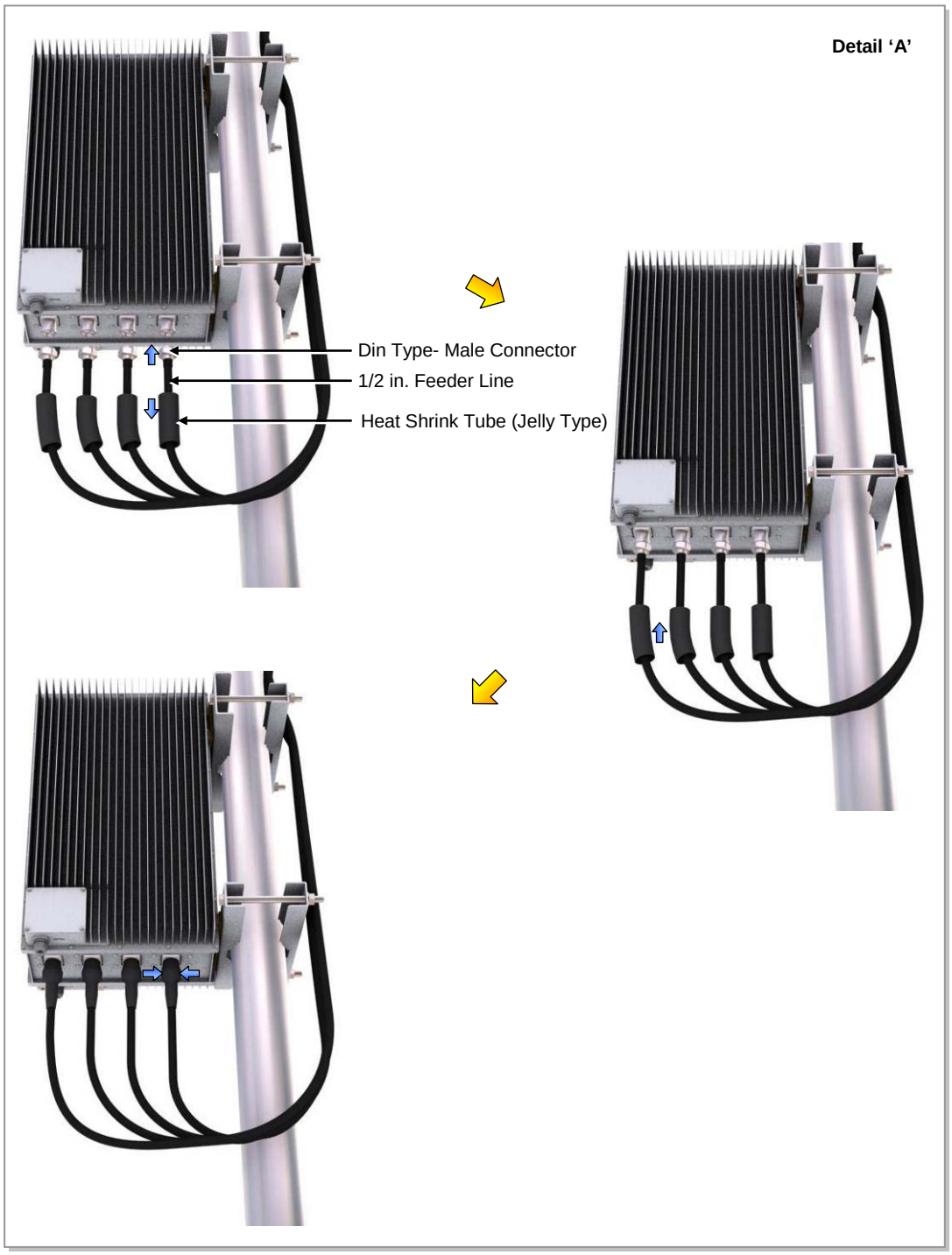


Figure 2.13 Connecting RRH-P4 Feeder Line (1)

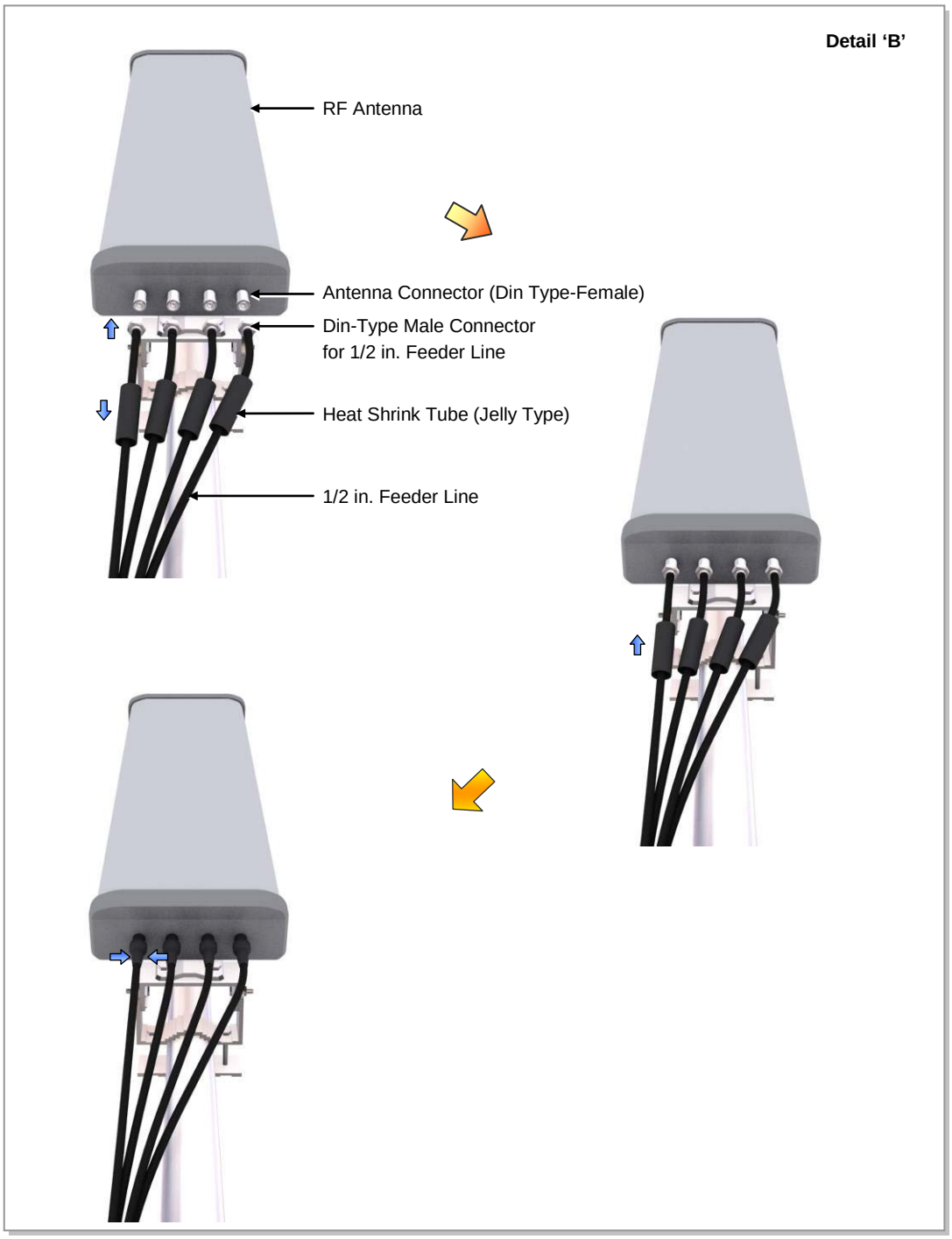


Figure 2.14 Connecting RRH-P4 Feeder Line (2)

CHECK

Caution for connecting Feeder Line Connector

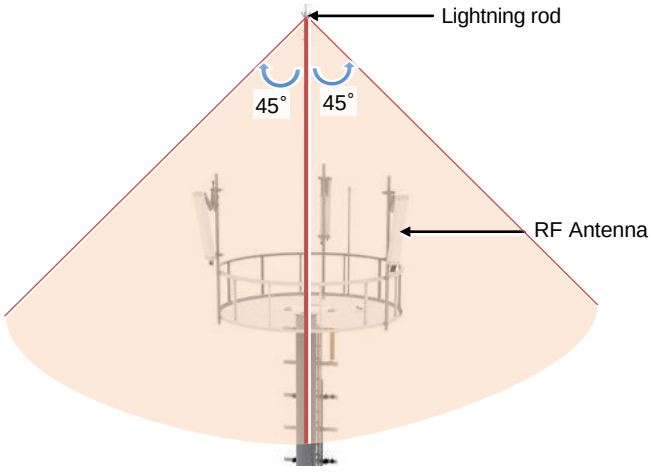
When connecting the feeder line between RRH-P4 RF port and RF antenna, each port and the feeder line connector should be tighten by 14.46 lbf.ft (200 kgf.cm) torque to minimize influence of PIMD.

CAUTION

Caution when Installing the RF antenna

To protect from lightning, the RF antenna must be installed within the shielding angle as shown below, considering the downward distance and the angle from the tower lightning rod or the antenna pole lightning rod.

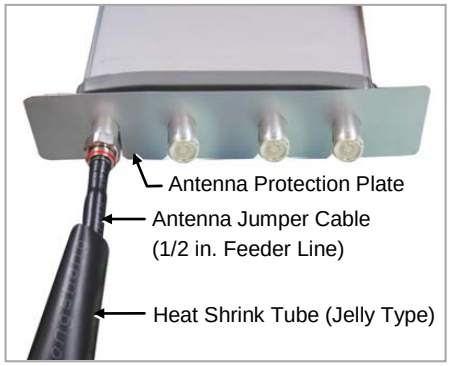
- The protection angle of the lightning rod should be 45 degrees.

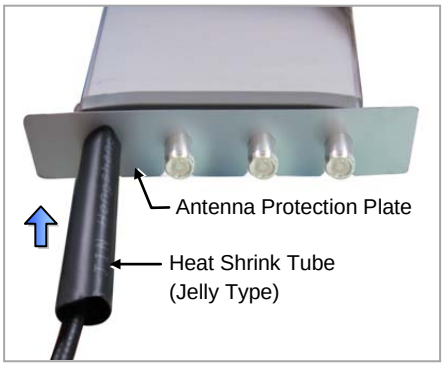


CAUTION

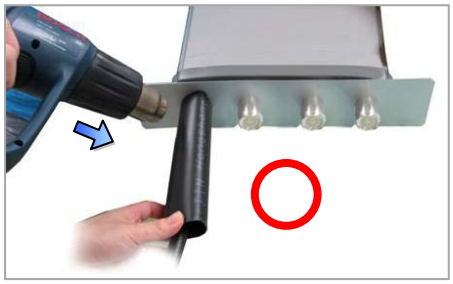
Finishing Heat Shrink Tube of a Sector Antenna

1) Insert an antenna protection plate.
2) Place the heat shrink tube on the connection point and shrink the heat shrink tube using a heat gun.



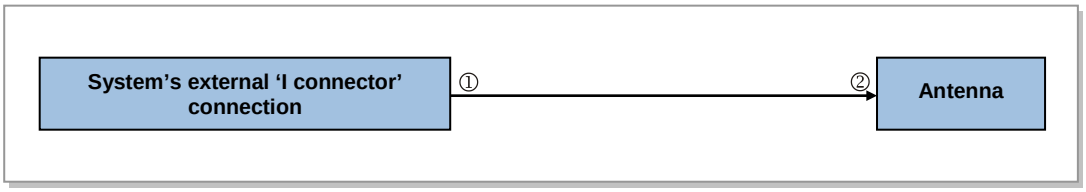


3) Avoid aiming the heating gun toward the antenna's body as shown in the figure below.



Checking Feeder line Connection

After connecting the feeder line, perform the continuity test and feeder cable return loss to check if the feeder cable is changed and measure VSWR of antenna and feeder cable.



Take measurements for the sections ①-② for all of the cables.
The standing wave ratio must be equal to or less than the reference value. If not, the cable must be removed, measured for each section again, and necessary actions be taken.

CHECK

VSWR Standard

The standing wave ratio (VSWR) of the cable and connector between the system's RF port to the antenna port must be smaller than 1.5 (return loss: 14 dB).
If a separate standard has been established with the career, the established standard will take precedence.

Identification tag installation

Attach the identification tag in the below table to the feeder line.

Table 2.2 GPS Identification Tag of Feeder line

Category	Description
Installation position	Attach the identification tag to the both ends of the antenna.
Materials	Use the material of aluminum coated by vinyl for the identification tag.
Fixing method	Fix the feeder cable to the 2 holes on the identification tag with the black cable tie.
Marking	The markings must be prevented from being erased by using relief engraving or coated labels.

2.6.2 Connecting RET cable

Follow the steps below to connect the Remote Electrical Tilting (RET) cable used to control the tilting angle of the antenna from the distance.

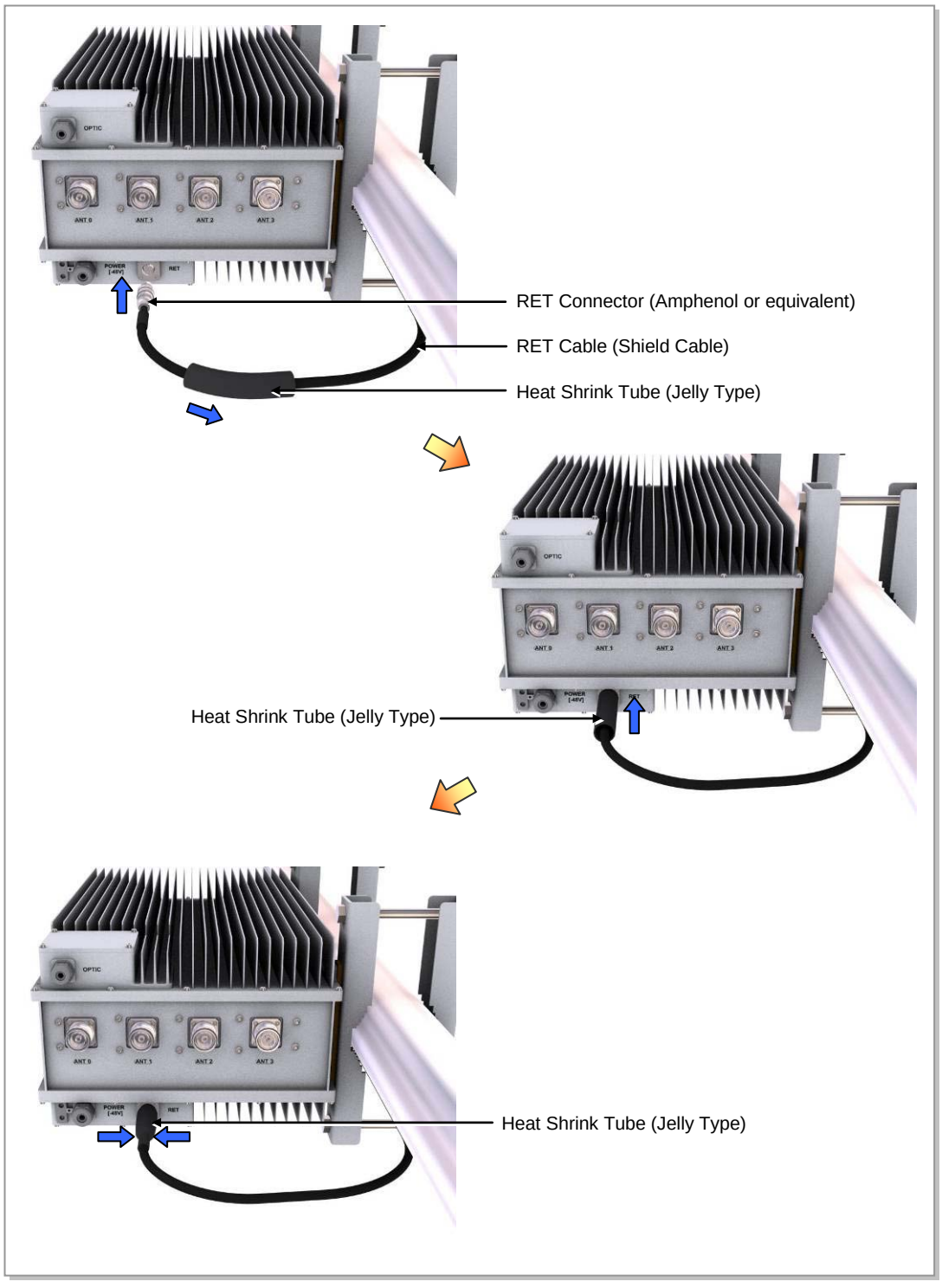


Figure 2.15 Connecting RET cable

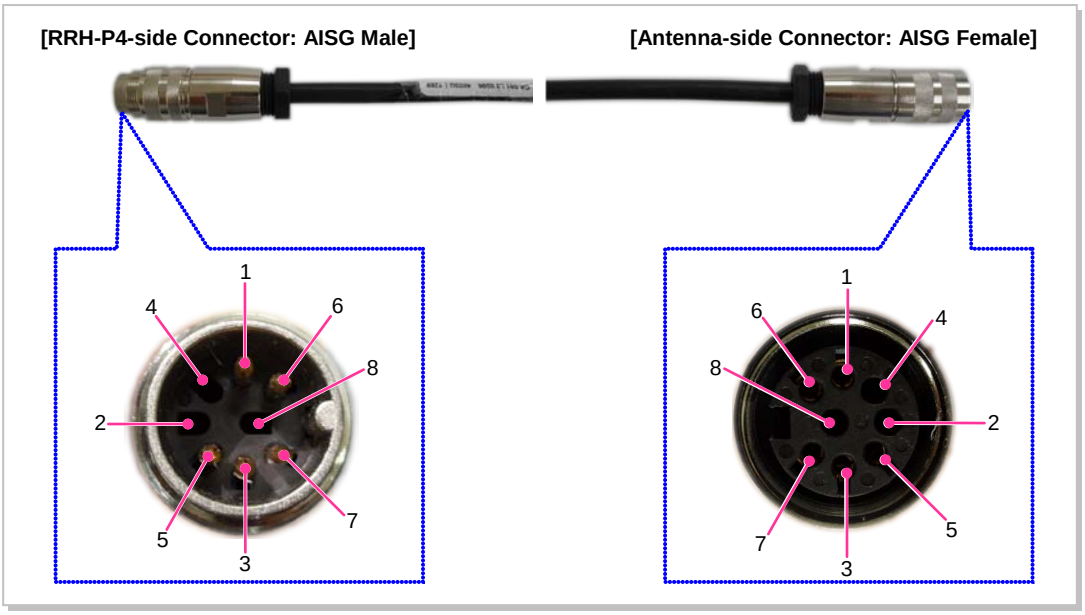


Figure 2.16 RET Cable connector

Table 2.3 RET Cable-Side Connector Pin Map

Amphenol AISG Connector		
Male	**Function**	**Female**
1	+12 V Optional (N.C)	1
2	N.C	2
3	RS485 B	3
4	RS485 GND	4
5	RS485 A	5
6	+21 V	6
7	+21 V RTN	7
8	N.C	8

CAUTION

Caution When Connecting RET Cable

Make sure to turn off the breaker connected to the RRH-P4 power of the DU cabinet before connecting the RET cable between the antenna RET port and the RRH-P4 RET port.

If you connect or disconnect the RET cable while the breaker is turned on, it may cause an electric short circuit resulting in damage to the RET function.

RET

- When 21 VDC volts are applied, the current supplied to the RET from RRH-P4 must be 1 A or lower.
- The exterior of the RET connector must be made of metal without vent hole or other UL certified material.

2.7 Connecting Ground Cable

2.7.1 Grounding RRH-P4

Follow the steps below to connect the RRH-P4 ground cable.

1) Install one ground cable (AWG8, GV 6 mm^2 × 1 C) from TGB to the ground terminal at the bottom of RRH-P4.
2) Install the pressure terminal and the heat shrink tube at the end of the cable.
   - Pressure Terminal: 6 mm^2, 2hole, 90°, Hole Diameter: 1.4 in. (6.3 mm), Hole Distance: 0.63 in. (16 mm)
3) Place the pressure terminal at one end of the ground cable of RRH-P4 aligning with the fixing holes and fix it using M6 SEMS.
   (When being tighten by screw, apply 2.76~3.37 lbf.ft (38.16~46.64 kgf.cm) torque.)

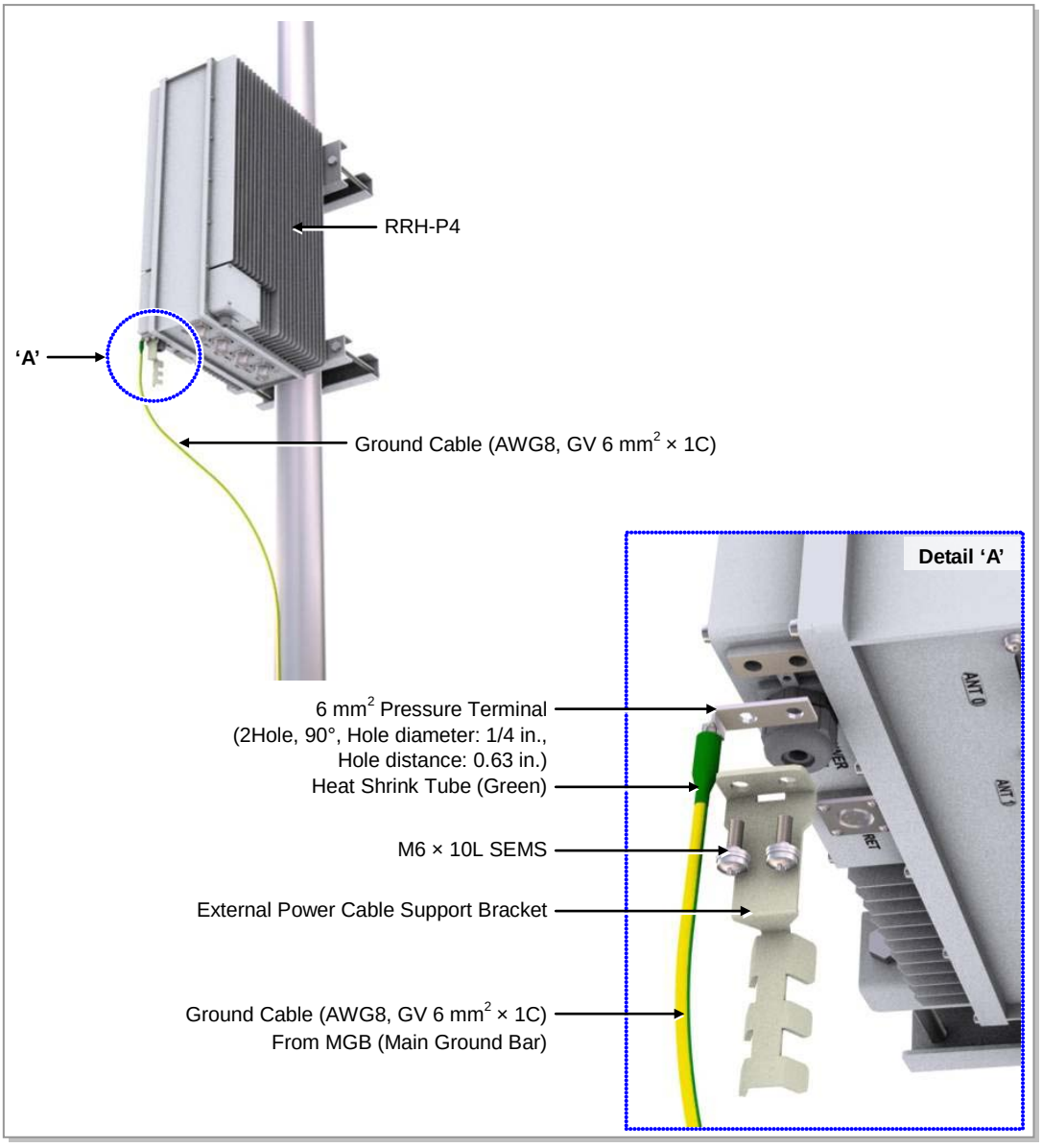


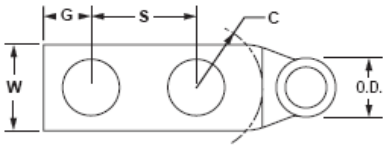
Figure 2.17 Connecting RRH-P4 Ground cable

CHECK

Pressure terminal

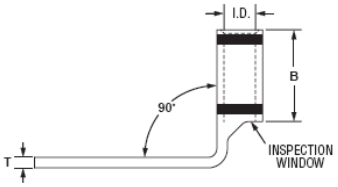
As for the pressure terminal or the cable, the UL Listed products or equivalent should be used.

Ex) Manufacturer-Panduit
RRH-P4: 6 mm^2 Pressure Terminal (LCD8-14AF-L)



When connecting the pressure terminal to a cable, remove the cable sheath where the pressure terminal is connected, and then push the cable all the way to the end of the cable lead-in part.

Check the position of the coaxial cable through the inspection window of the pressure terminal before compressing it with a compressor.



CAUTION

Caution when losing External Power Cable Support Bracket

External Power Cable Support Bracket and two cable tie (stainless steel) for fixing cable are enclosed in RRH-P4 package. Be careful not to lose when unpacking package.

2.8 Connecting Hybrid cable

2.8.1 Installing Hybrid cable

Follow the steps below to install the hybrid cable.

1) Unpack the box. (A-D)
2) Pull up the tower. (E-F)

A) Use a crowbar to open the wooden box cover.
After opening the cover, ensure to remove the remaining nails as they may cause injury.

B) Hold both ends of the hybrid cable and lift it out of the box. Tape the power cable and optic cable separately at 3.28 ft (1 m) interval. Also, tape the exposed optic connector to prevent damage.

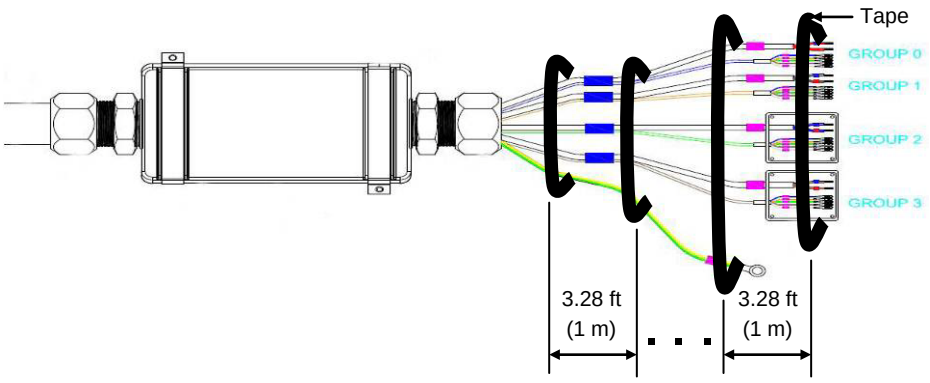


Figure 2.18 Installing Hybrid cable (1)

C) Take the cable out of the box paying attention not to impact the junction box and the jumper cable. Be careful not to drag the jumper cable on the floor.

D) Lay the hybrid cable on the floor.

Figure 2.19 Installing Hybrid cable (2)

E) Install pulling wire to the 3.28 ft (1 m) point of (RRH side) hybrid cable's junction box (breakout point) bottom. Wind the pulling wire by 7 times or more to the 3.28 ft (1 m) or more length of hybrid cable.

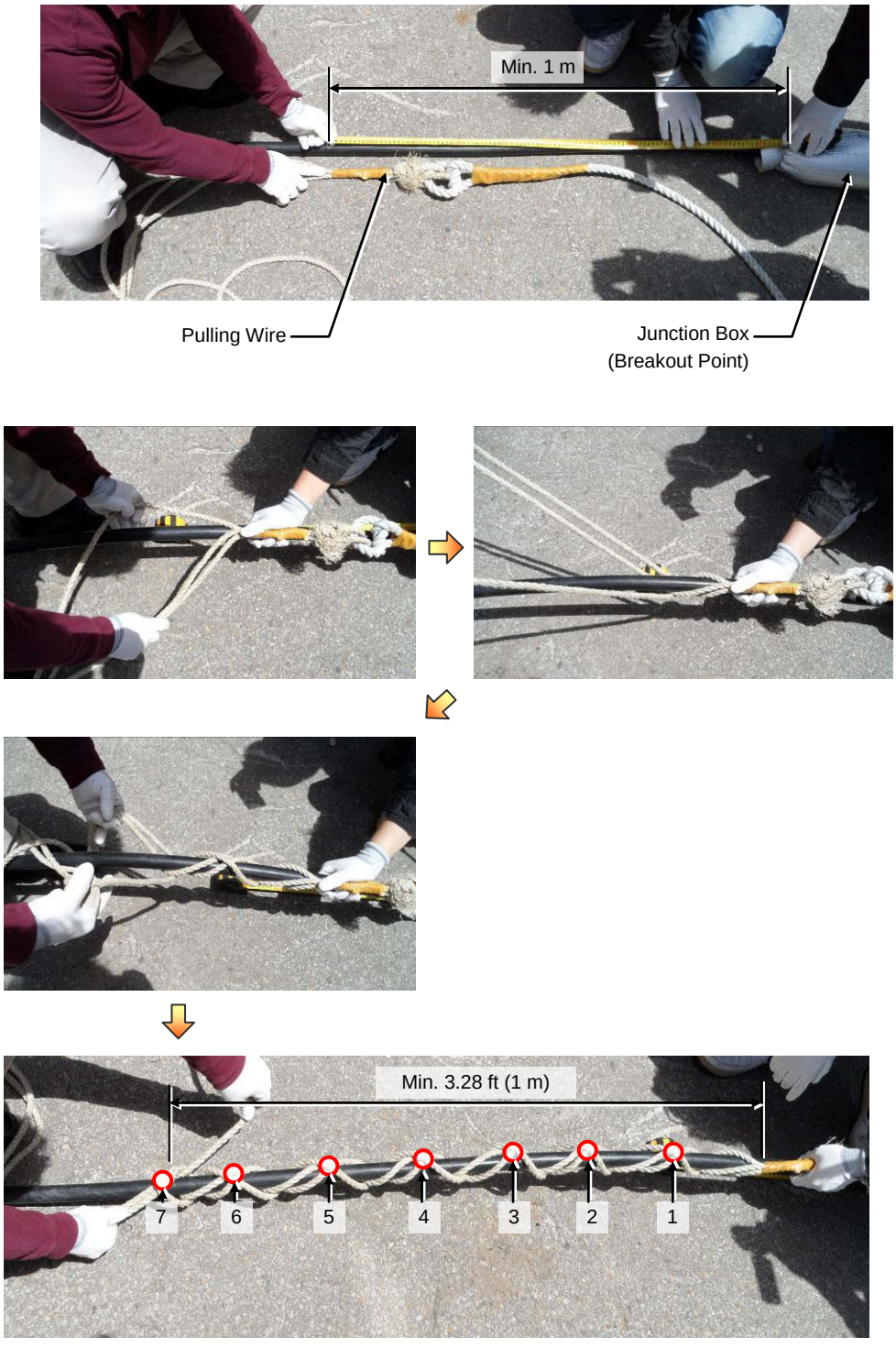


Figure 2.20 Installing Hybrid cable (3)

F) Fix the cable to the hoisting wire with a cable tie at regular intervals [within 3.28 ft (1 m)] to prevent impact or tension to the upper side of the junction box when lifting the hoist.
Maintain hoisting wire in a straight line, separate the RRH-side cable's curve from the hoisting wire with 5.9 in. (150 mm) or more distance. And fix cable and wire with cable tie.
(When lifting the hoist, be careful not to apply tension to other areas of the hybrid cable except where the pulling wire is attached.)

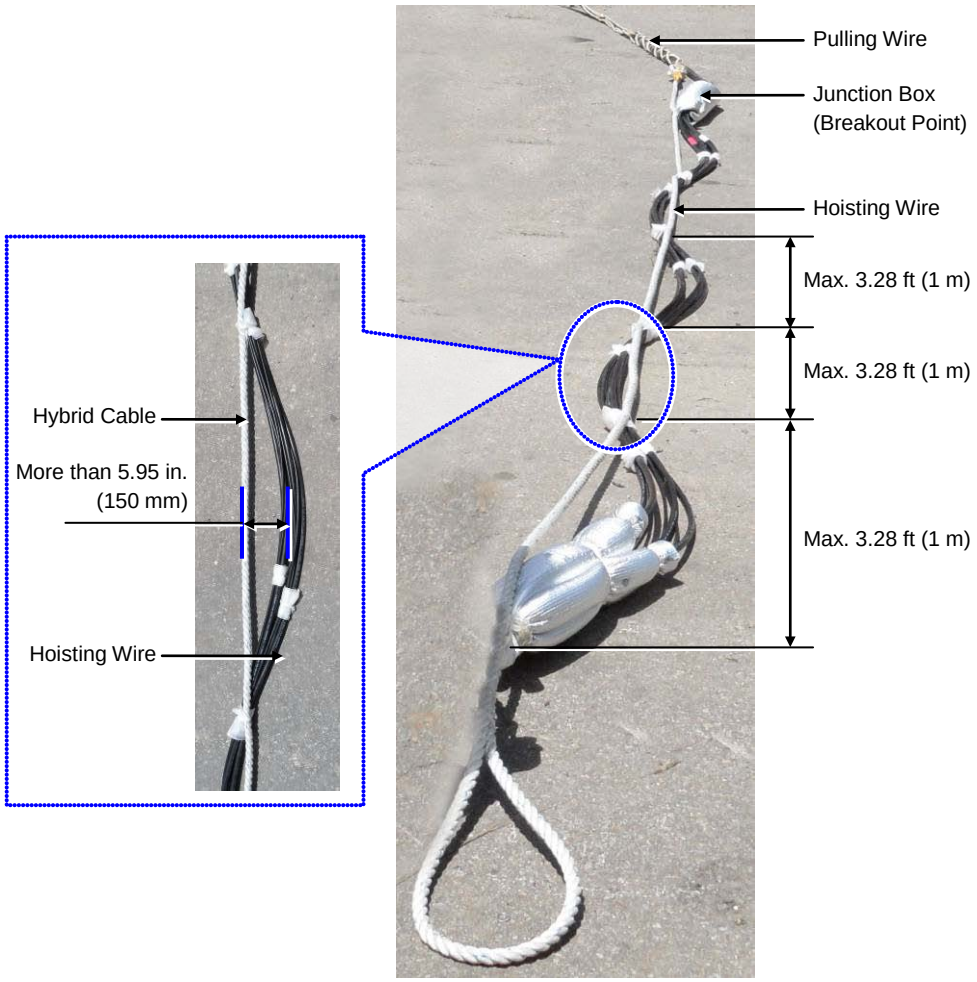
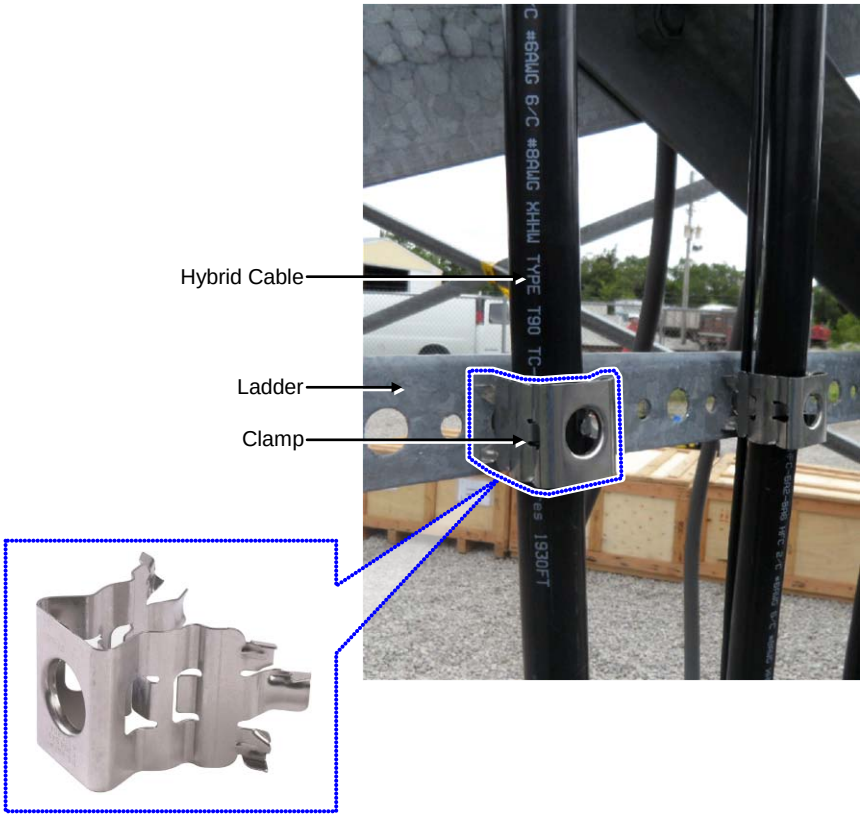


Figure 2.21 Installing Hybrid cable (4)

NOTE

Hybrid cable mounting clamp and installation standards

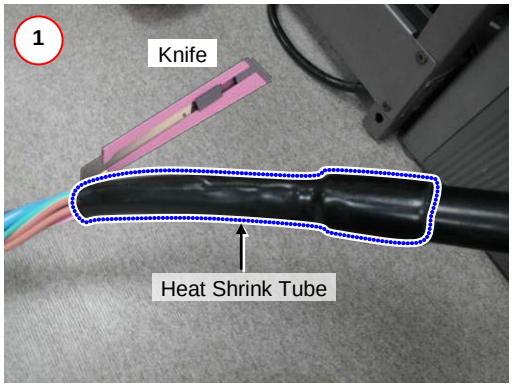
When fixing hybrid cable to the tower ladder, use the clamp of photo below and fix use of a clamp, and fix cable with fixed-interval of once per 3 ft.



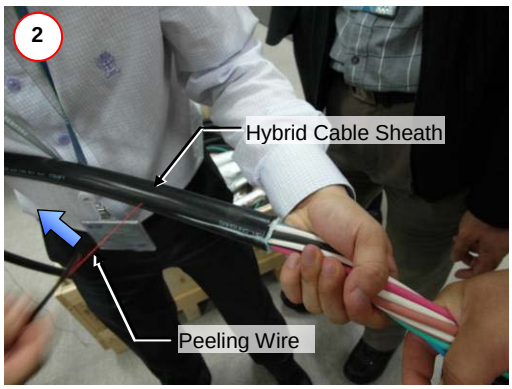
2.8.2 Connecting DU Cabinet side cable

If the length of the hybrid cable is inadequate for the installation:

1) Measure the hybrid cable's excess length.
   (With a white marker pen, mark the area of the cable where the double-layer sheath will be peeled when positioned in the conduit fitting.)
2) Using a knife, peel off the heat shrink tube that binds the cables together.
3) Pull the peeling wire in the inside of the hybrid cable's double-layer sheath down to the previously marked area.
4) Peel off the hybrid cable's sheath.
5) Peel off the aluminum foil wrapped around the inner cable.
6) For all power cables, leave 23.62 in. (600 mm) from where the double-layer sheath has been peeled off and cut the excess length off.
7) Unsheathe the end of the power cable wire at 0.59 in. (15 mm).
8) Using a conduit, insert the hybrid cable's power cable and optic cable together into the cabinet. Be careful not to damage the optic cable's connector.
9) From the inside of the cabinet, pull the optic cable to the right side of the system and attach temporarily with a cable tie.
10) Using a flat-head screwdriver (-, 1x100), turn the RRH power terminal's screw counter-clockwise twice to 3 times.
11) Insert the power cable to the terminal according to its use and polarity, then fasten the screw with a torque of 1.3~1.59 lbf.ft (18~22 kgf.cm).
12) Bind two cables (-48 V, RTN) at 3.94 in. (100 mm) from the terminal using a cable tie.
13) Bury the optic cable following the system's inner-right wall up to the UADU#0 side and bind using a cable tie.
14) Connect the connector of the optic cable to UADU's designated port. (Loop the optic cable's excess length respecting the bending radius 'R=4.33 in. (110 mm)', and arrange it in the cable tray box. Be careful not to damage the optic cable during other works.)



1) Using a knife, peel off the heat shrink tube that binds the cables together.



2) Pull the peeling wire to cut the hybrid cable's sheath.

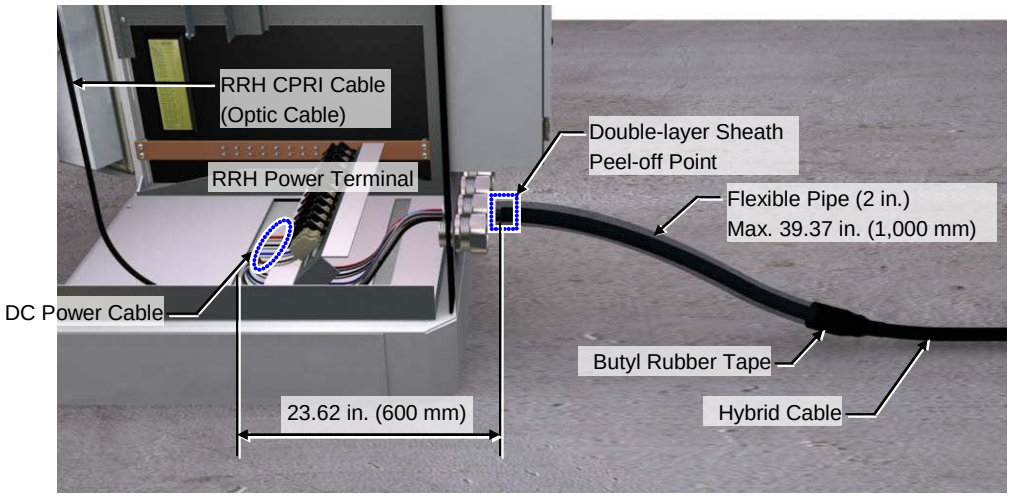
3) Peel off the hybrid cable's sheath.

4) Peel off the aluminum foil wrapped around the inner cable.

Figure 2.22 Peeling off the Hybrid Cable Sheath

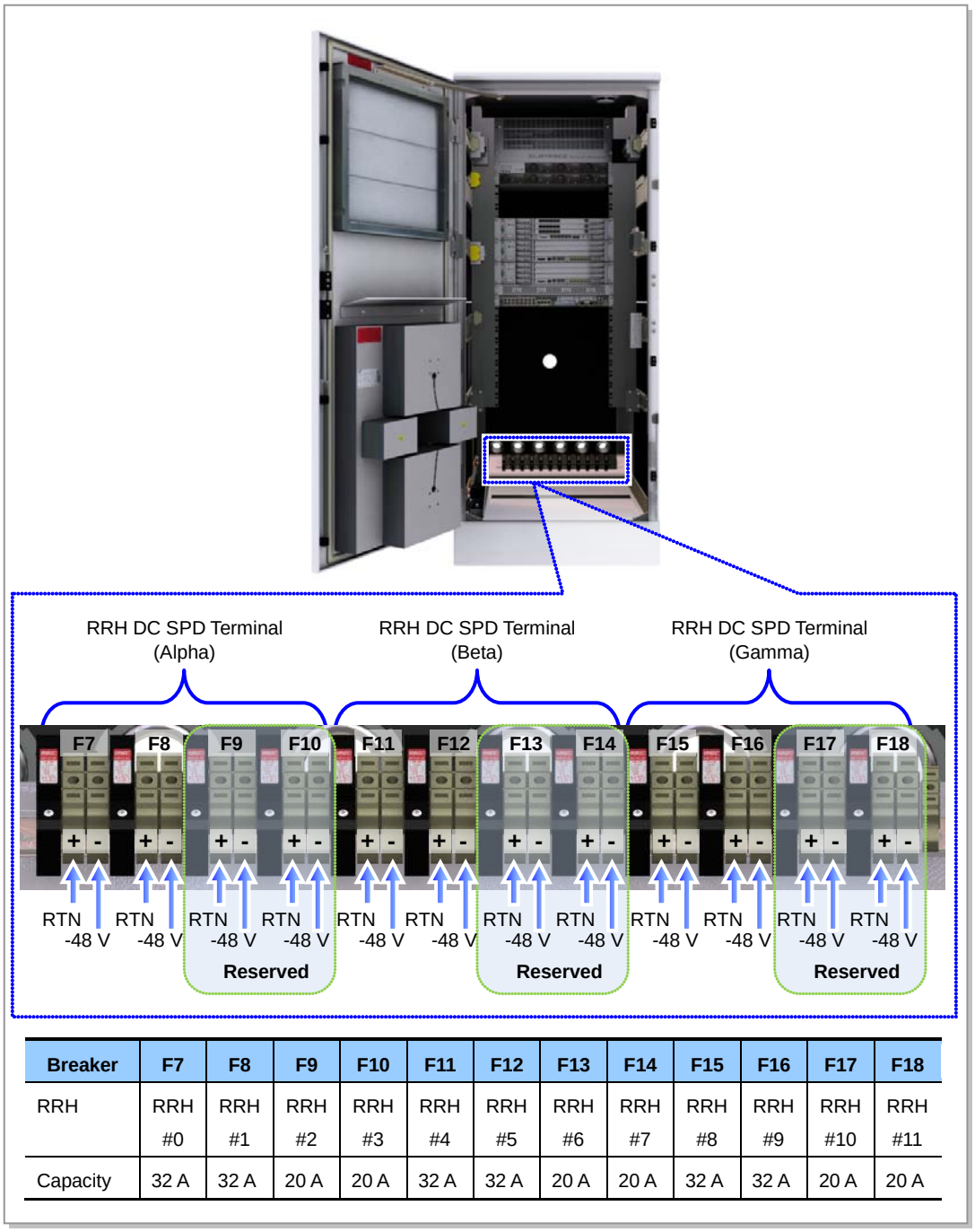
If the length of the hybrid cable is adequate for the installation:

1) For all power cables, leave 23.62 in. (600 mm) from where the double-layer sheath has been peeled off and cut the excess length off.
2) Unsheathe the end of the power cable wire at 0.59 in. (15 mm) length.
3) Using a conduit, insert the hybrid cable's power cable and optic cable together into the cabinet. Be careful not to damage the optic cable's connector.
4) From the inside of the cabinet, pull the optic cable to the right side of the system and attach temporarily with a cable tie.
5) Using a flat-head screwdriver (-, 1x100), turn the RRH power terminal's screw counter-clockwise 2 to 3 times.
6) Insert the power cable to the terminal according to its usage and polarity, then fasten the screw.
7) Bind two cables (-48 V, RTN) at 3.94 in. (100 mm) from the terminal using a cable tie.
8) Bury the optic cable following the system's inner-right wall up to the UADU#0 side and bind using a cable tie.
9) Connect the connector of the optic cable to UADU's designated port. (Loop the optic cable's excess length respecting the bending radius 'R=4.33 in. (110 mm)', and arrange it in the cable tray box. Be careful not to damage the optic cable during other works.)



[Baseband Rack Right View]

Figure 2.23 Connecting Hybrid cable (1)



Breaker	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
RRH	RRH #0	RRH #1	RRH #2	RRH #3	RRH #4	RRH #5	RRH #6	RRH #7	RRH #8	RRH #9	RRH #10	RRH #11
Capacity	32 A	32 A	20 A	20 A	32 A	32 A	20 A	20 A	32 A	32 A	20 A	20 A

Figure 2.24 Connecting Hybrid cable (2)

Table 2.4 Hybrid Cable Color Map

	Group 0 (1.9 GHz)	Group 1 (800 MHz)	Group 2 (2.5 GHz)	Group 3 (2.5 GHz)
Return	White/Red stripe	White/Black stripe	White/Blue stripe	White/Brown stripe
-48 V	Red	Black	Blue	Brown

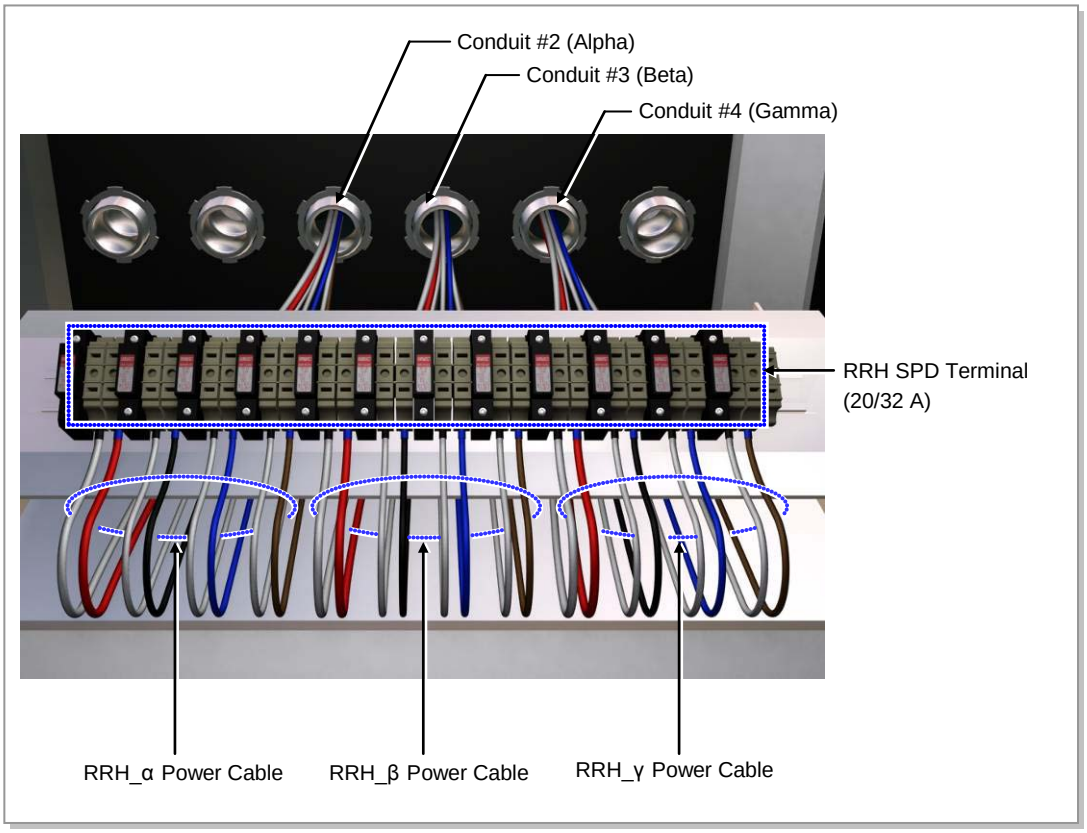


Figure 2.25 Connecting Hybrid cable (3)

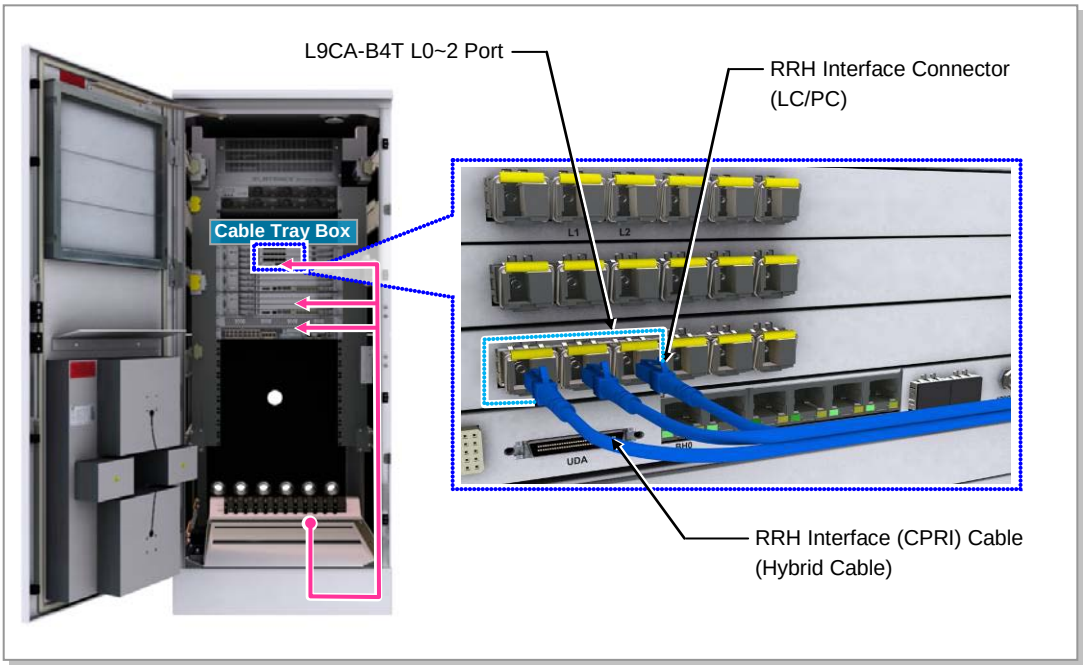


Figure 2.26 Connecting Hybrid cable (4)

Managing unused port

Finish unused port of UADU by dust-cap, not making the alien substance flowed.

Finishing Cable Insertion Hole

Finishing work is required on cable insertion holes (Cable gland, Conduit and etc.) to prevent entering of any foreign substance, external air and moisture.

- Unused cable insertion hole: Finish cable insertion hole using fishing materials such as dust cap, rubber packing and etc.
- Cable-installed insertion hole: After installing cable, finish insertion hole using tape, compressed sponge, rubber packing, silicon, etc. to prevent empty space.

2.8.3 Connecting RRH-P4 Power Cable

When using the power cable (AWG8)

Follow the steps below to connect the power cable to RRH-P4.

1) Unscrew the power window cover fixing screw located at the rear bottom of RRH-P4 using a Torx (T20) screwdriver. (The cover fixing screw is designed to remain attached to the cover.)

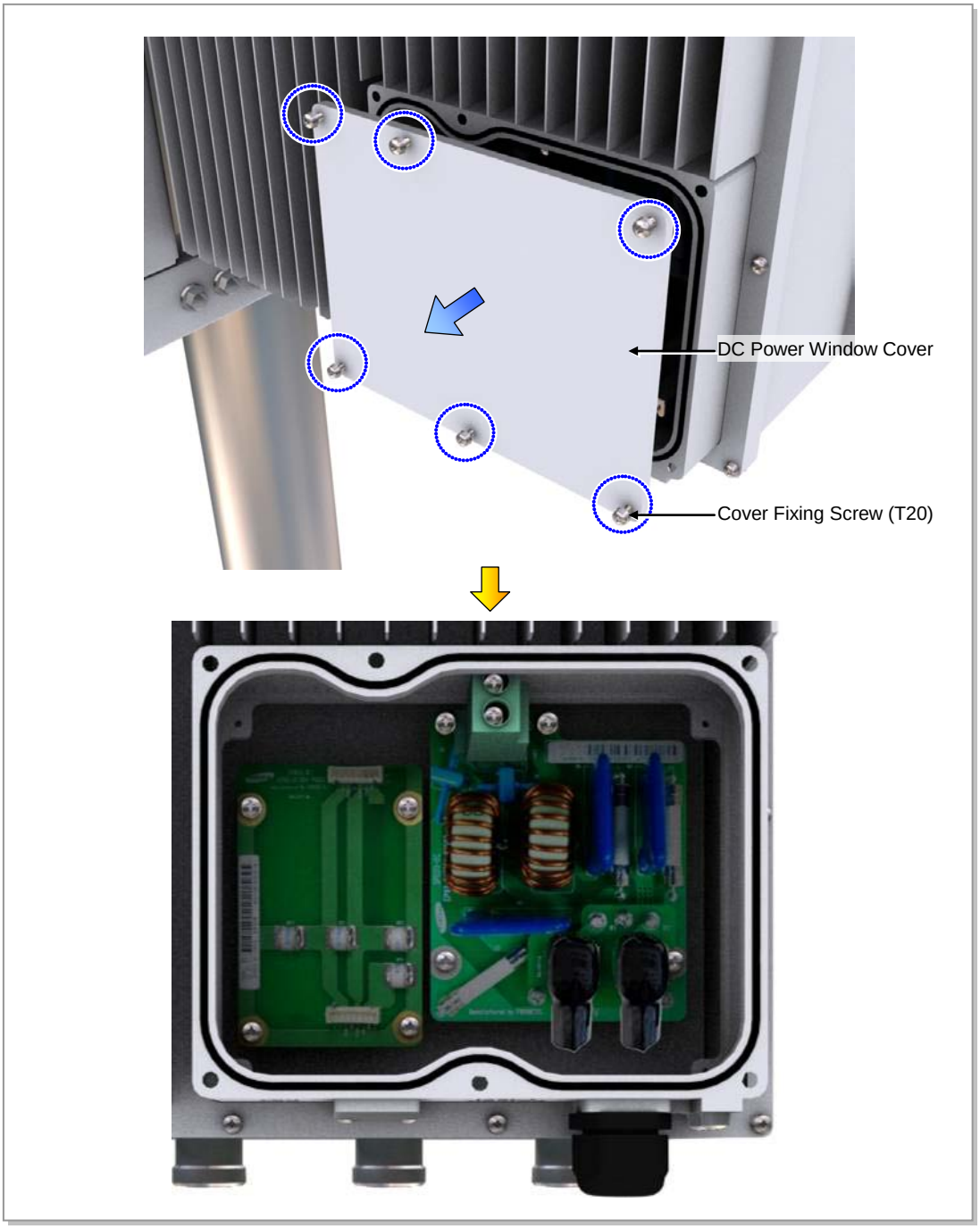


Figure 2.27 Connecting RRH-P4 power cable (AWG8) (1)

2) Install one power cable (hybrid cable, AWG8, 2C) connected to the baseband rack's DC SPD terminal to the RRH-P4 power terminal. (Refer to the 'Caution for installing the power cable').

3) Cut cable installed to the power terminal. Unsheathe outer cable sheath at 1.77 in. (45 mm) length and peel off the inner wire at 0.39 in. (10 m) length.

4) Insert heat shrink tube [0.59 in. (15 mm)] at the inner wire and shrink the pressure terminal (AWG8).
   • Pressure Terminal: AWG8, ring type, hole diameter: 0.2 in. (5.3 mm)

5) Locate heat shrink tube (-48 V: blue, RTN: red) at pressure terminal and shrink the heat shrink tube using a heat gun.

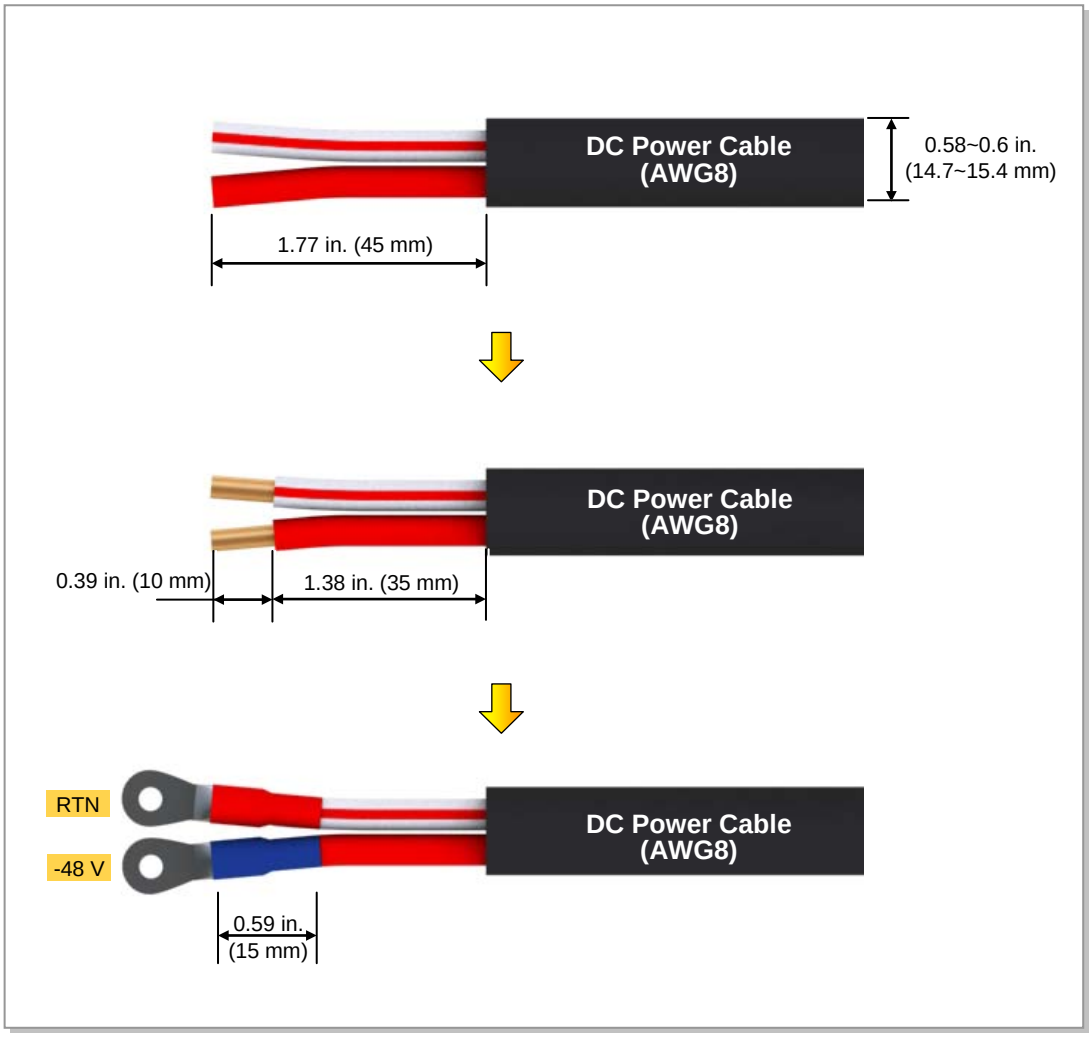
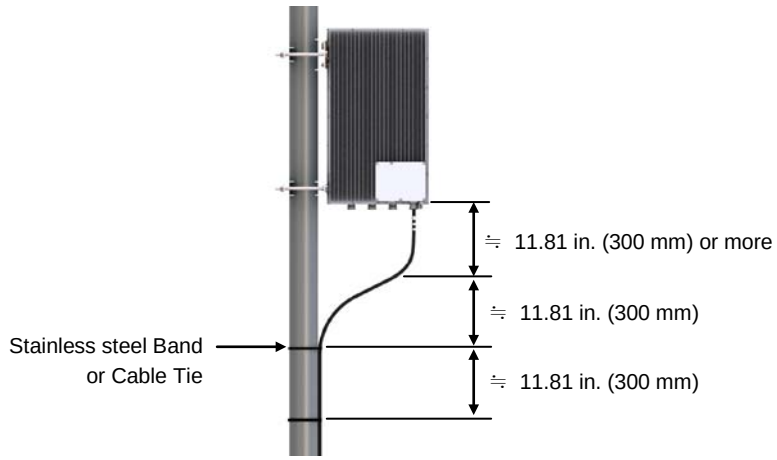


Figure 2.28 Connecting RRH-P4 power cable (AWG8) (2)

Caution for installing the power cable

To maintain cable gland's rain protection performance, 11.81 in. (300 mm) or more interval should be kept straight. According to the radius of curvature of the cable specification should be considered.



Caution for cutting the power cable

Cut power cable after installing power cable to RRH-P4 power terminal taking into account the radius of curvature according to the cable specifications.

When cutting the cable first, the length difference of cable end can be occurred by cable curvature and the power terminal may cause contact fault.

6) Remove the power terminal protection cap from the power terminal block.

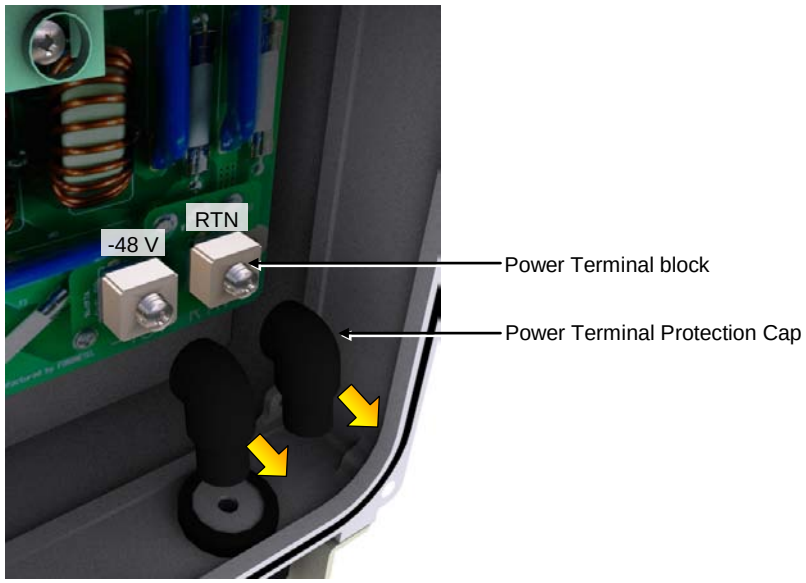


Figure 2.29 Connecting RRH-P4 power cable (AWG8) (3)

7) Remove the rain protection filler and the cable gland nut from the power cable input hole located at the bottom of RRH-P4.

8) Insert the separated rain protection filler and the cable gland nut to the power cable (Hybrid cable, AWG8, 2C).

9) Insert the power cable from the bottom of the equipment through the cable gland, then install within the power window.

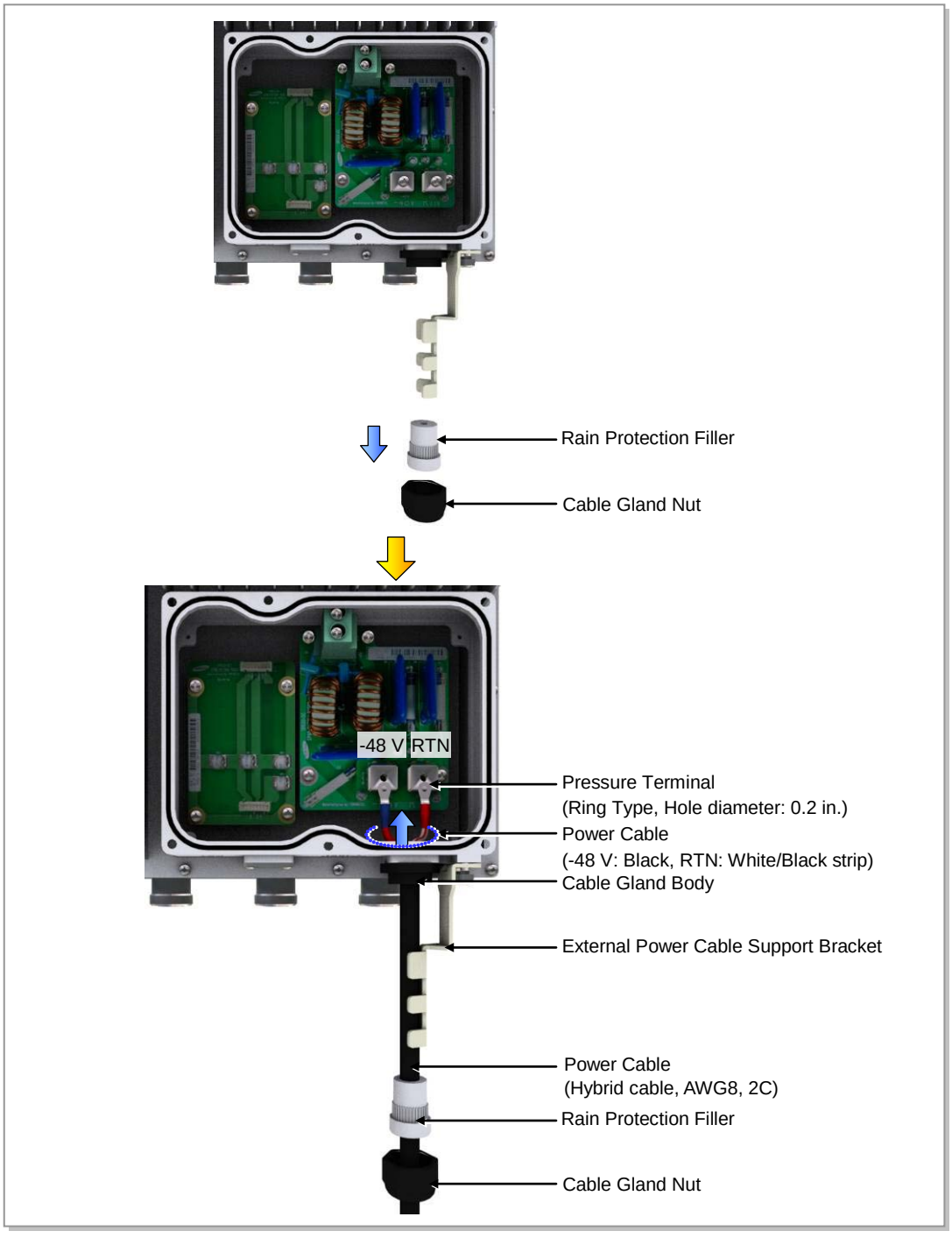


Figure 2.30 Connecting RRH-P4 power cable (AWG8) (4)

10) Insert power terminal protection cap to the installed power cable.

11) Align the pressure terminal of the power cable to the power terminal block for proper polarity and fix it with M5 screw.

12) After fixing the pressure terminal, cover the power terminal block with power terminal protection cap.

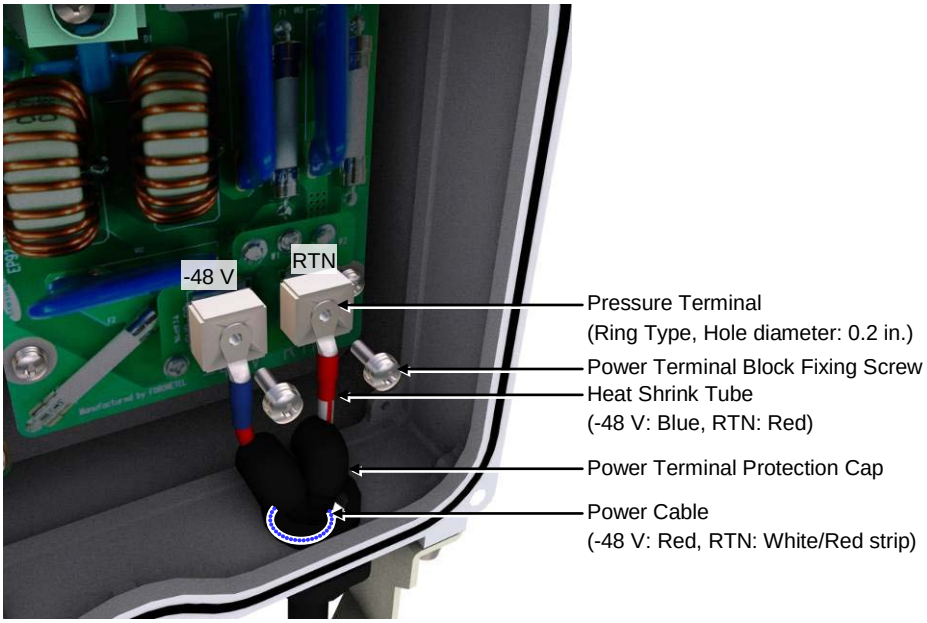


Figure 2.31 Connecting RRH-P4 power cable (AWG8) (5)

13) Insert the rain protection filler completely to cable gland body and fasten the cable gland nut by torque 2.17 lbf.ft (30 kgf.cm) using torque wrench. After fixing nut, confirm using the gap gauge that distance between cable gland body and nut is within 0.03 in. (1.0 mm).

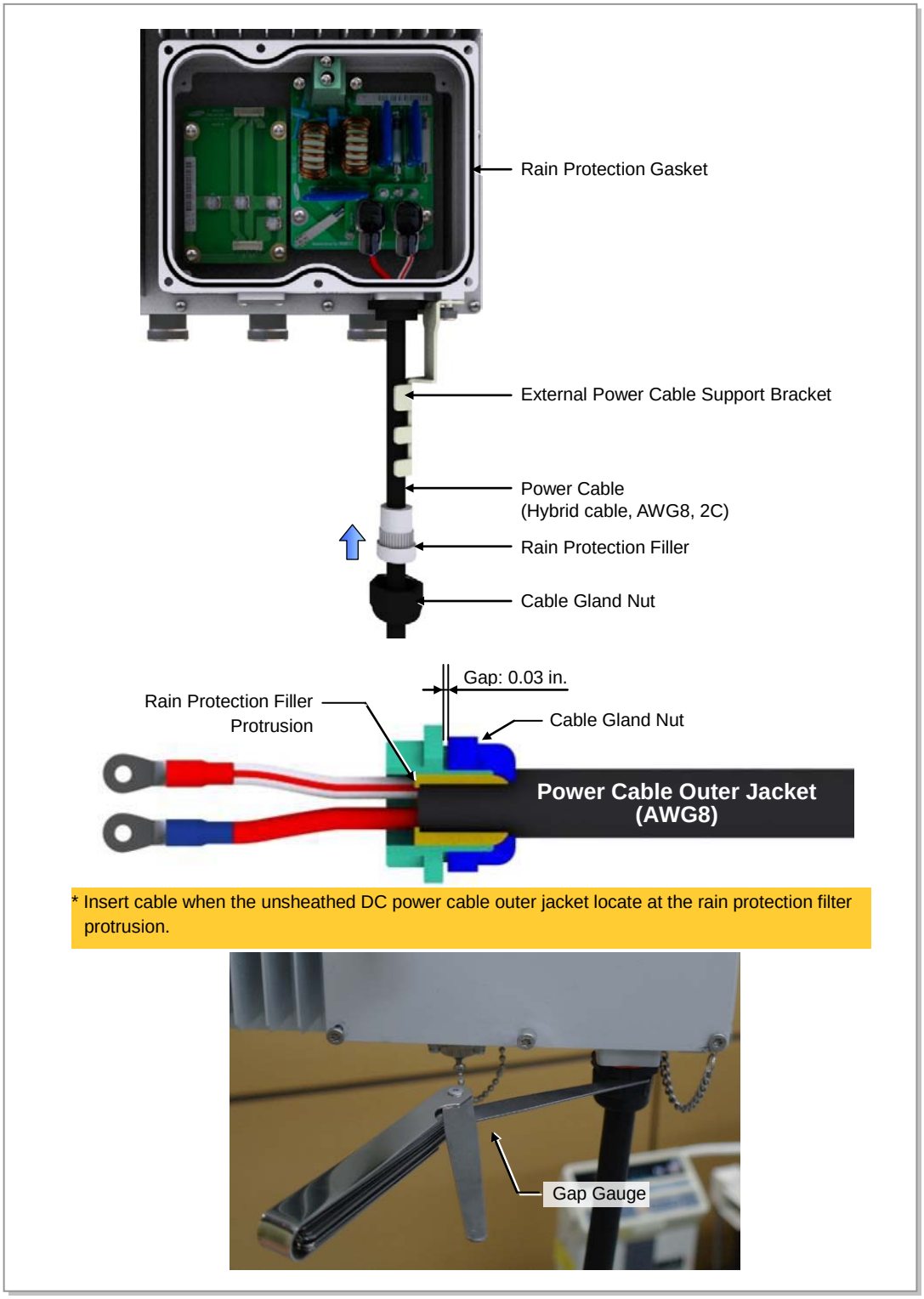


Figure 2.32 Connecting RRH-P4 power cable (AWG8) (6)

14) Close the power window cover after connecting power cable. And tighten the screws by torque 0.87 lbf.ft (12 kgf.cm) with torque driver (T20). Tighten the screws in order of ① → ② → ③ → ④ → ⑤ → ⑥.

15) Fixing the external power cable of RRH-P4 and the external power cable support bracket with stainless steel tie.

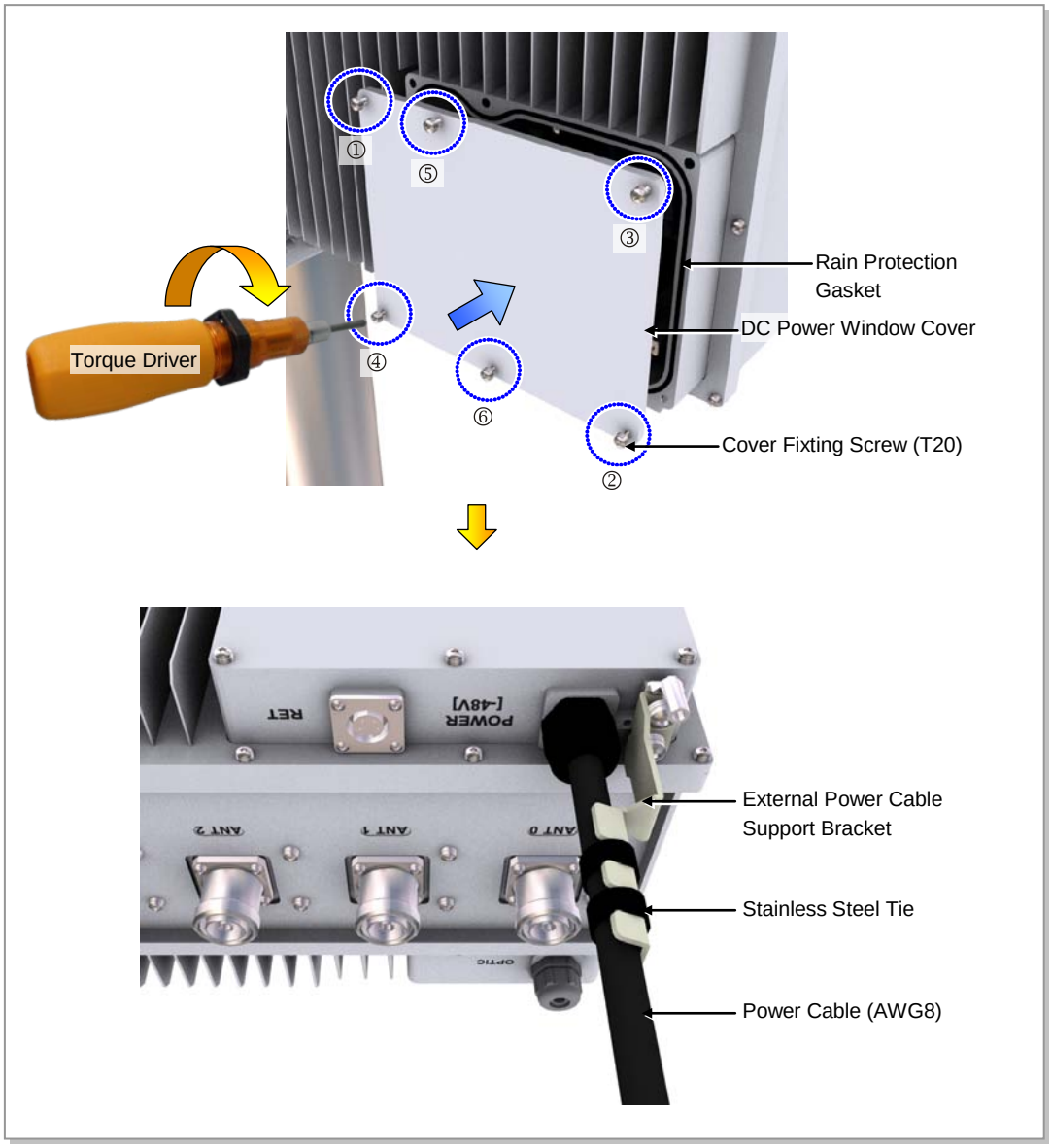


Figure 2.33 Connecting RRH-P4 power cable (AWG8) (7)

WARNING

Caution When Opening and Closing Power Window Cover

Make sure to turn off the breaker connected to the RRH-P4 power before opening or closing the power window cover of the RRH-P4.

If you open or close the power window cover when the breaker is turned on, it may cause damage to the system, or cause an electric short circuit resulting in severe injury.

CAUTION

Caution on Rain-proof Gasket Damage When Installing Window Cover

Be careful so as not to let the rain-proof gasket get damaged (broken or incorrectly positioned). Check whether the rain-proof gasket is damaged before closing the power window cover and the optic window cover.

If the rain-proof gasket is damaged, replace the system (RRH-P4) with a new one.

CAUTION

Caution When Fixing Power Cable

If you do not use a stainless steel tie to fix the power cable and the power cable bracket, the cable tension may cause a connection failure or leakage. Make sure to fix the power cable using a stainless steel tie.

You may need to use a tool designated for fixing with a stainless steel tie.

NOTE

Tool for fastening Stainless Steel tie

When fastening stainless steel tie, the tool (Equivalent to the following specifications) is recommended to fix External power cable support bracket and power cable.

Ex) Manufacture-Dong A bestech
Part No.: DAS 250

CHECK

Installing the Circuit Breaker

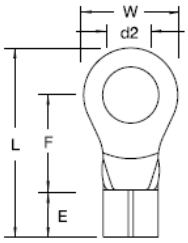
To ensure stability in power supply, a circuit breaker must be installed on the power cable connected to the rectifier (or power distributor).
Capacity of -48 VDC circuit breaker is 32 A.

CHECK

Pressure terminal

As for the pressure terminal or the cable, the UL Listed products or equivalent should be used.

Ex) RRH-P4 AWG8 (6 mm^2)Type
: Manufacturer-Spec-Kon, Part No: K8-10R-D



When using the power cable (AWG10)

Follow the steps below to connect the power cable to RRH-P4.

1) Unscrew the power window cover fixing screw located at the rear bottom of RRH-P4 using a Torx (T20) screwdriver. (The cover fixing screw is designed to remain attached to the cover.)

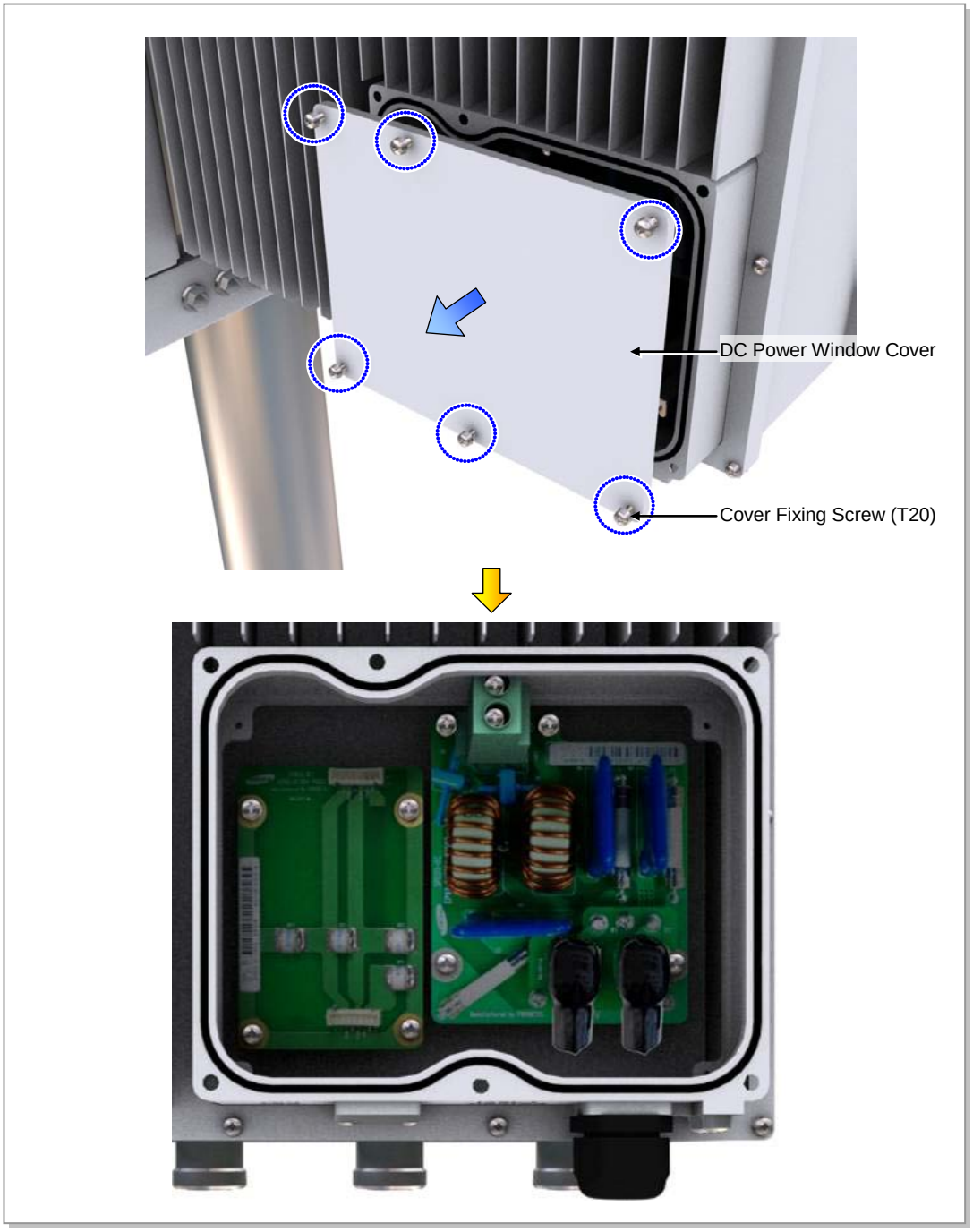


Figure 2.34 Connecting RRH-P4 power cable (AWG10) (1)

2) Install one power cable (hybrid cable, AWG10, 2C) connected to the baseband rack's DC SPD terminal to the RRH-P4 power terminal. (Refer to the 'Caution for installing the power cable').

3) Cut cable installed to the power terminal. Unsheathe outer cable sheath at 1.38 in. (35 mm) length and peel off the inner wire at 0.39 in. (10 mm) length.

4) Insert a heat shrink tube (0.59 in./15 mm) for each inner wire and compress the wire with pressure terminal (AWG10).
   • pressure terminal: AWG10, ring type, hole diameter: 0.2 in. (5.3 mm)

5) Align the heat shrink tube (-48 V: blue, RTN: red) at the compressed part of the pressure terminal and shrink the tube using the heating gun.

6) Fix heat shrink tube (jelly type, 12/4, 1.97 in. (50 mm)] at stripped external sheath and shrink the heat shrink tube using a heat gun. At this time, match the end of unsheathed external cable and the end of heat shrink tube.

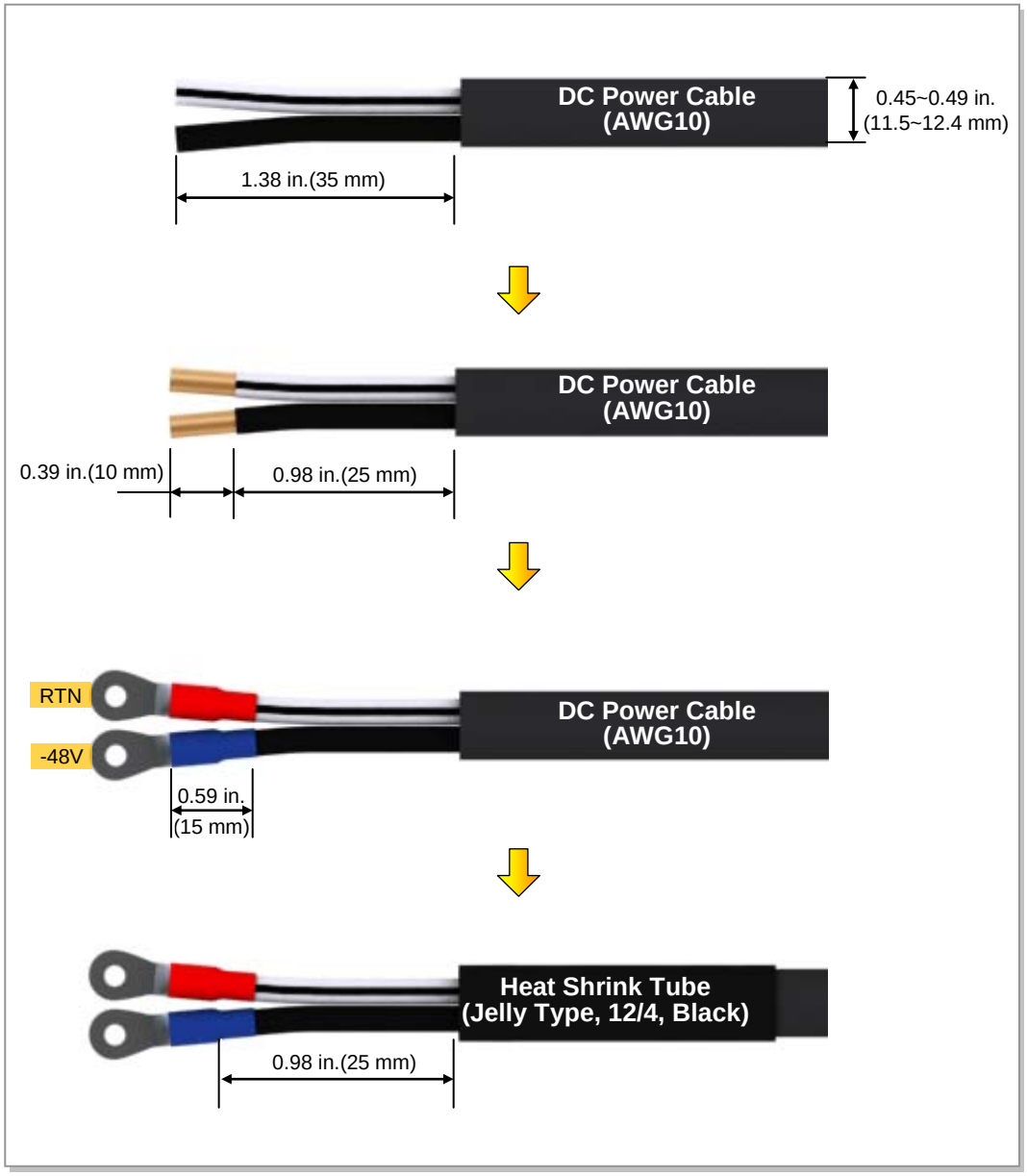
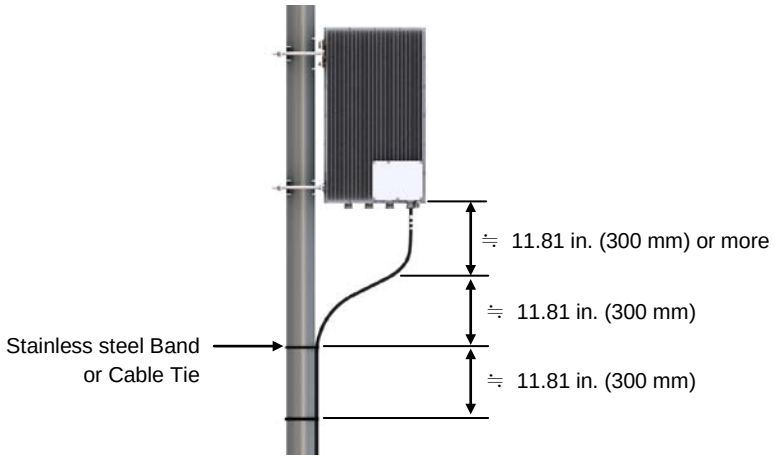


Figure 2.35 Connecting RRH-P4 power cable (AWG10) (2)

Caution for installing the power cable

To maintain cable gland's rain protection performance, 11.81 in. (300 mm) or more interval should be kept straight. According to the radius of curvature of the cable specification should be considered.



Caution for cutting the power cable

Cut power cable after installing power cable to RRH-P4 power terminal taking into account the radius of curvature according to the cable specifications.

When cutting the cable first, the length difference of cable end can be occurred by cable curvature and the power terminal may cause contact fault.

7) Remove the power terminal protection cap from the power terminal block.

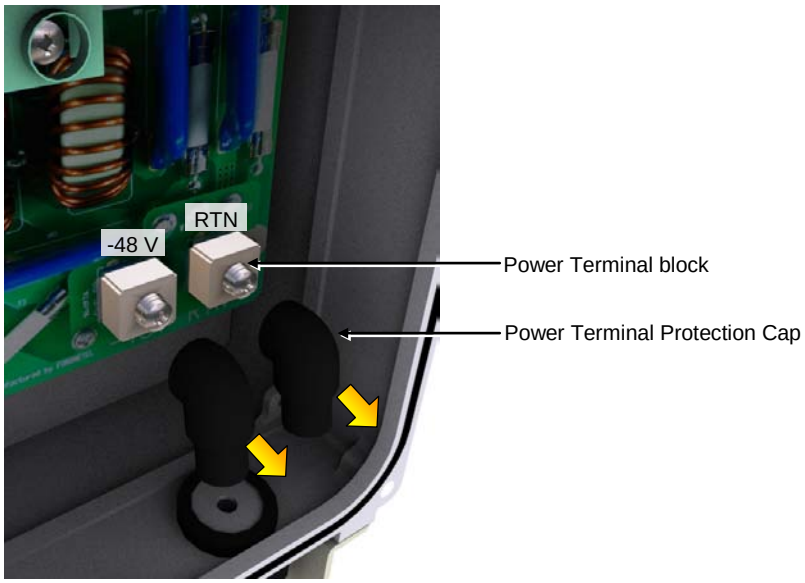


Figure 2.36 Connecting RRH-P4 power cable (AWG10) (3)

8) Remove the rain protection filler and cable gland nut from the power cable input hole located at the bottom of RRH-P4.

9) Insert the separated rain protection filler and cable gland nut to the power cable (Hybrid cable, AWG8, 2C).

10) Insert the power cable from the bottom of the equipment through the power cable input hole, then install within the power window.

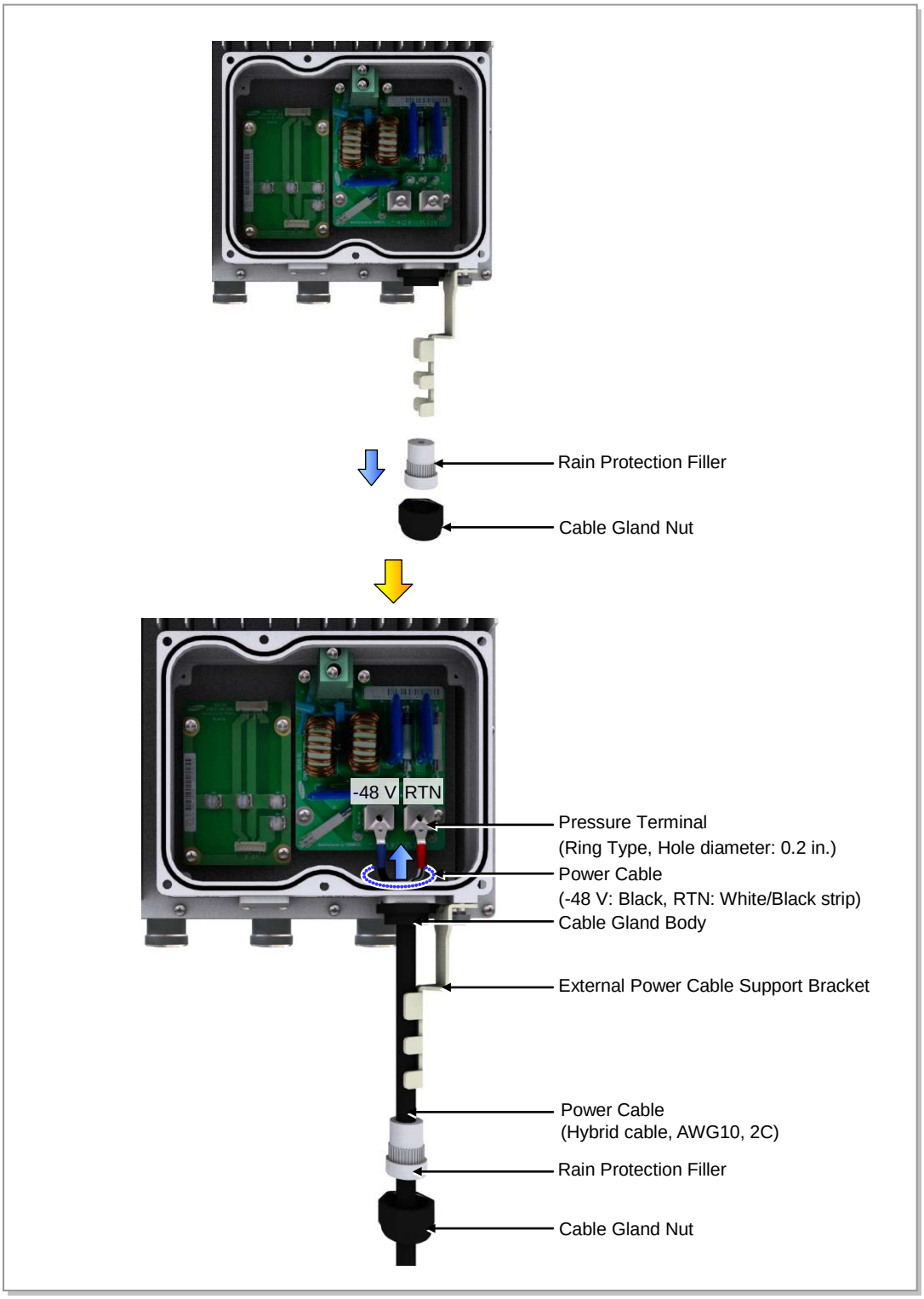


Figure 2.37 Connecting RRH-P4 power cable (AWG10) (4)

11) Insert power terminal protection cap to the installed power cable.

12) Align the pressure terminal of the power cable to the power terminal block for proper polarity and fix it with M5 screw.

13) After fixing the pressure terminal, cover the power terminal block with power terminal protection cap.

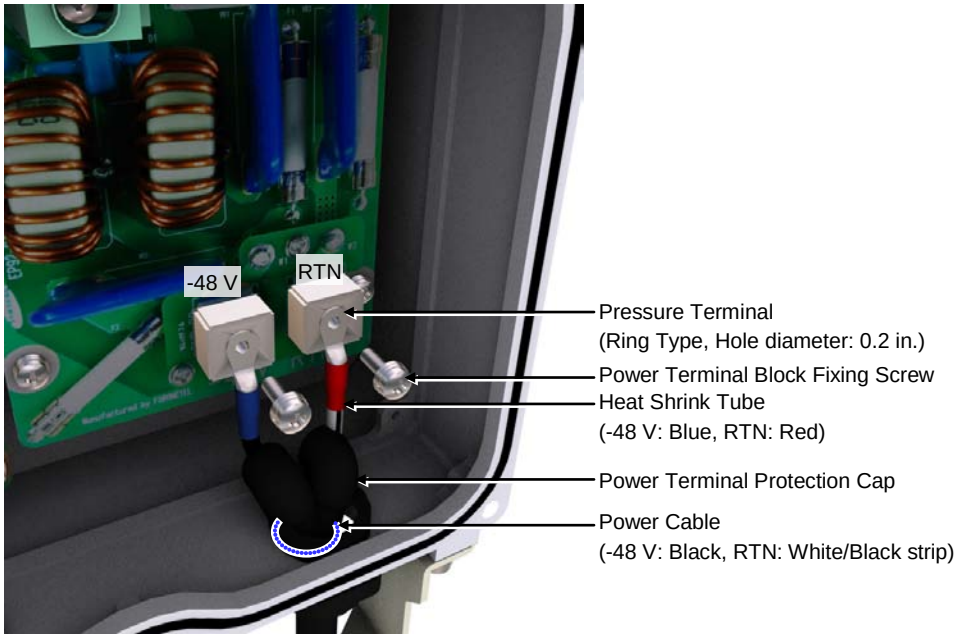


Figure 2.38 Connecting RRH-P4 power cable (AWG10) (5)

13) Insert the rain protection filler completely to cable gland body and fasten the cable gland nut by torque 2.17 lbf.ft (30 kgf.cm) using torque wrench. After fixing nut, confirm using the gap gauge that distance between cable gland body and nut is within 0.0 in. (0.0 mm).

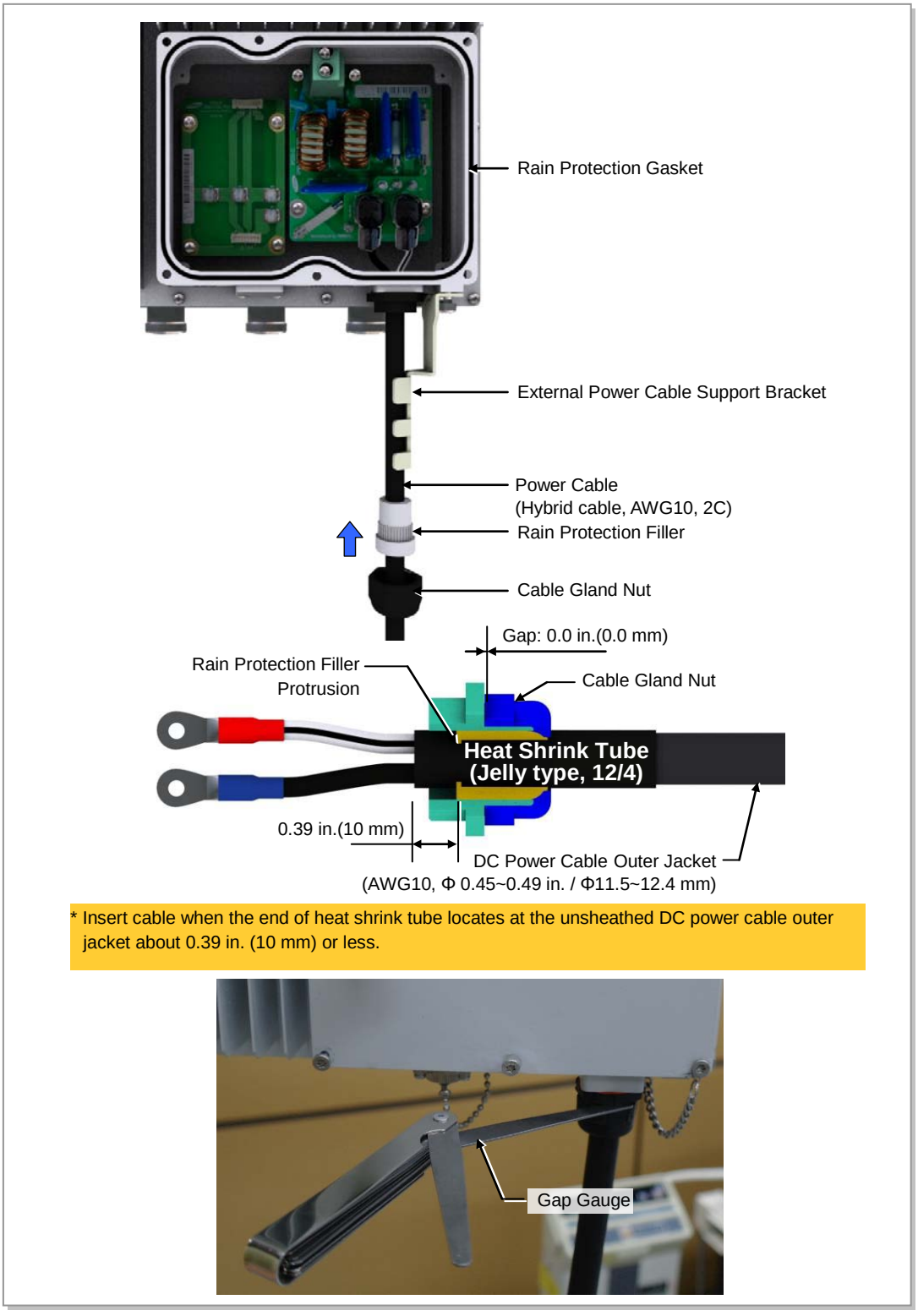


Figure 2.39 Connecting RRH-P4 power cable (AWG10) (6)

14) Close the power window cover after connecting power cable. And tighten the screws by torque 0.87 lbf.ft (12 kgf. cm) with torque driver (T20). Tighten the screws in order of ① → ② → ③ → ④ → ⑤ → ⑥.

15) Fixing the external power cable of RRH-P4 and the external power cable support bracket with stainless steel tie.

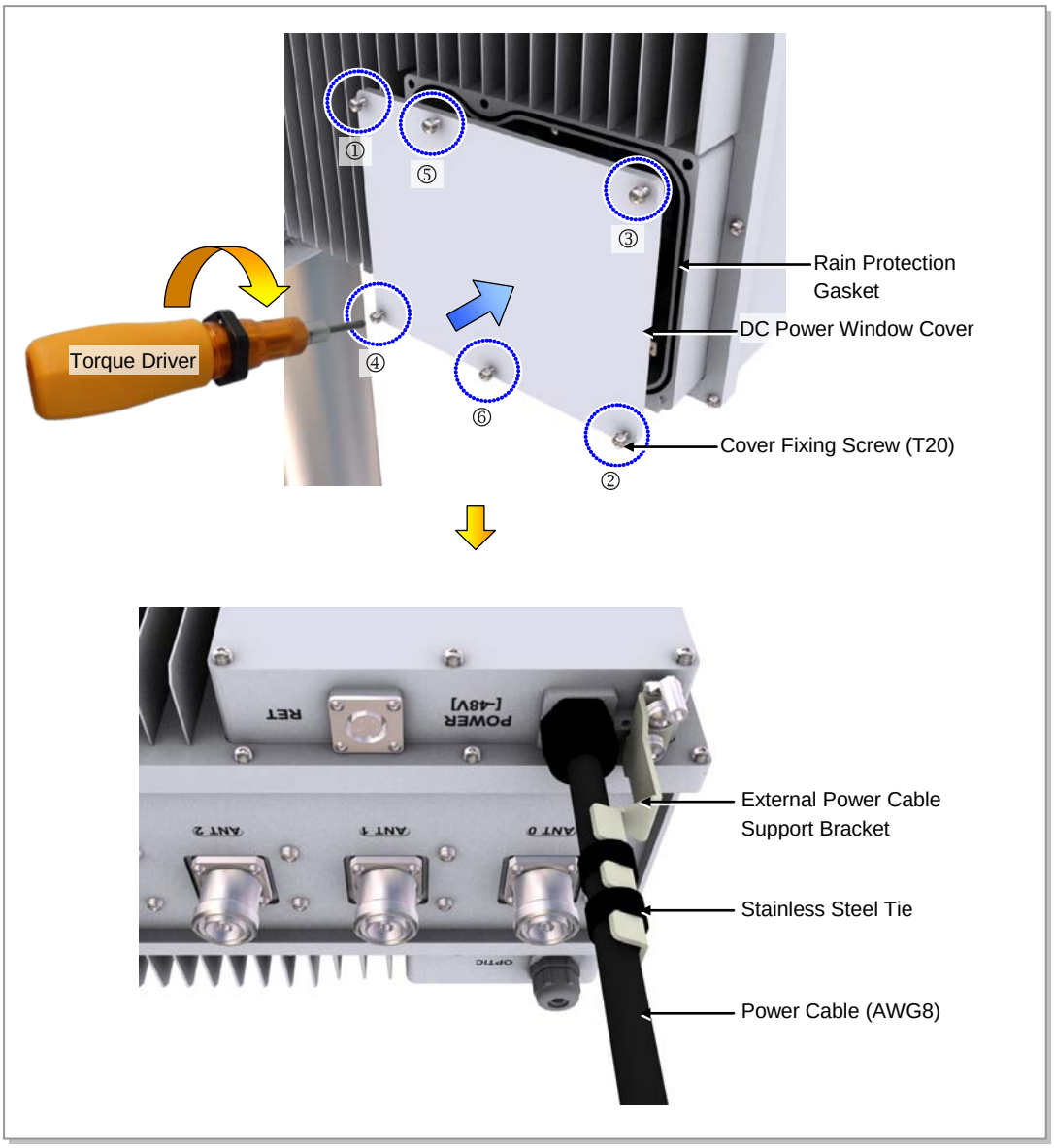


Figure 2.40 Connecting RRH-P4 power cable (AWG10) (7)

WARNING

Caution When Opening and Closing Power Window Cover

Make sure to turn off the breaker connected to the RRH-P4 power before opening or closing the power window cover of the RRH-P4.

If you open or close the power window cover when the breaker is turned on, it may cause damage to the system, or cause an electric short circuit resulting in severe injury.

CAUTION

Caution on Rain-proof Gasket Damage When Installing Window Cover

Be careful so as not to let the rain-proof gasket get damaged (broken or incorrectly positioned). Check whether the rain-proof gasket is damaged before closing the power window cover and the optic window cover.

IF the rain-proof gasket is damaged, replace the system (RRH-P4) with a new one.

CAUTION

Caution When Fixing Power Cable

If you do not use a stainless steel tie to fix the power cable and the power cable bracket, the cable tension may cause a connection failure or leakage. Make sure to fix the power cable using a stainless steel tie.

You may need to use a tool designated for fixing with a stainless steel tie.

NOTE

Tool for fastening Stainless Steel tie

When fastening stainless steel tie, the tool (Equivalent to the following specifications) is recommended to fix External power cable support bracket and power cable.

Ex) Manufacture-Dong A bestech
Part No.: DAS 250

CHECK

Installing the Circuit Breaker

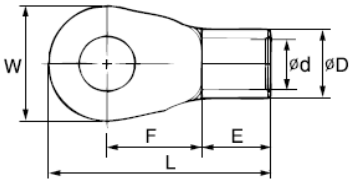
To ensure stability in power supply, a circuit breaker must be installed on the power cable connected to the rectifier (or power distributor).
Capacity of -48 VDC circuit breaker is 32 A.

CHECK

Pressure terminal

As for the pressure terminal or the cable, the UL Listed products or equivalent should be used.

Ex) RRH-P4 AWG10 (4 mm^2)Type
- Manufacturer: Donga bestech, Part No: PTSR0306



2.8.4 Connecting RRH-P4 CPRI cable

Follow the steps below to connect the CPRI cable for the interface between RRH-P4 and UADU.

1) Unscrew the optic window cover fixing screw located at the front bottom of RRH-P4 using a Torx (T20) screwdriver. (The cover fixing screw is designed to remain attached to the cover.)

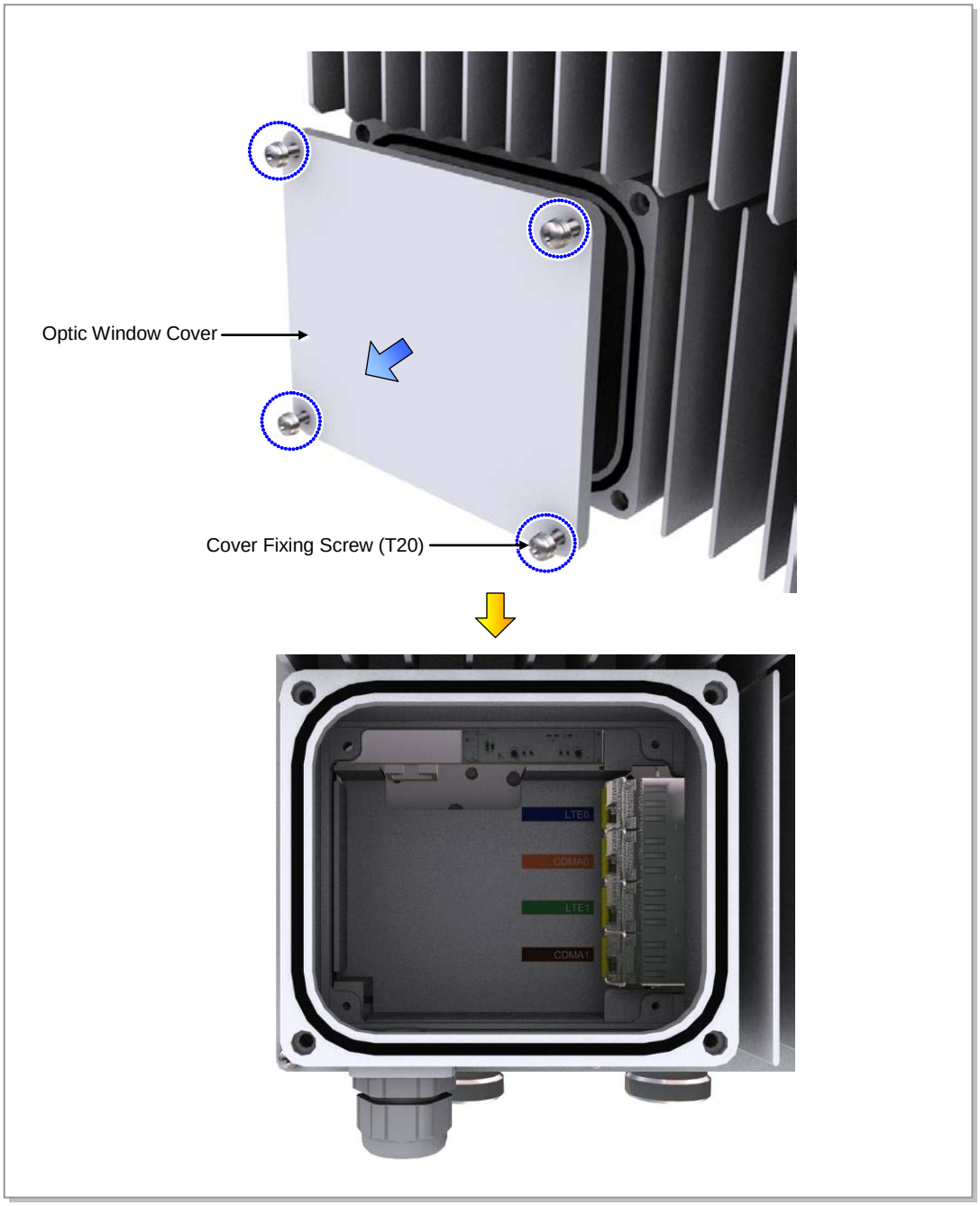


Figure 2.41 Connecting RRH-P4 CPRI cable (1)

2) Remove the cable gland nut and rain protection filler from the optic cable input hole located at the bottom of the equipment.

3) Insert the cable gland nut and the rain protection filler to the optic cable in respective order.

4) Insert the optic cable (5 core, 1 pc) from the bottom of the equipment through the optic cable input hole, then bury within the optic window. Insert the optic connector to the SFP module.
(Maintain the optic cable's minimum bending radius of R=0.79 in. (20 mm) to preserve the cable performance and prevent damage.)

5) When the connection of the optic connector is complete, allow approx. 0.39 in. (10 mm) of the optic cable's sheath in the box, insert the rain protection filler in the gland hole, then fasten the cable gland nut by torque 2.17 lbf.ft (30 kgf.cm) using torque wrench.

6) When the CPRI cable connection is complete, close the window cover and fasten the screw by torque 0.87 lbf.ft (12.0 kgf.cm).

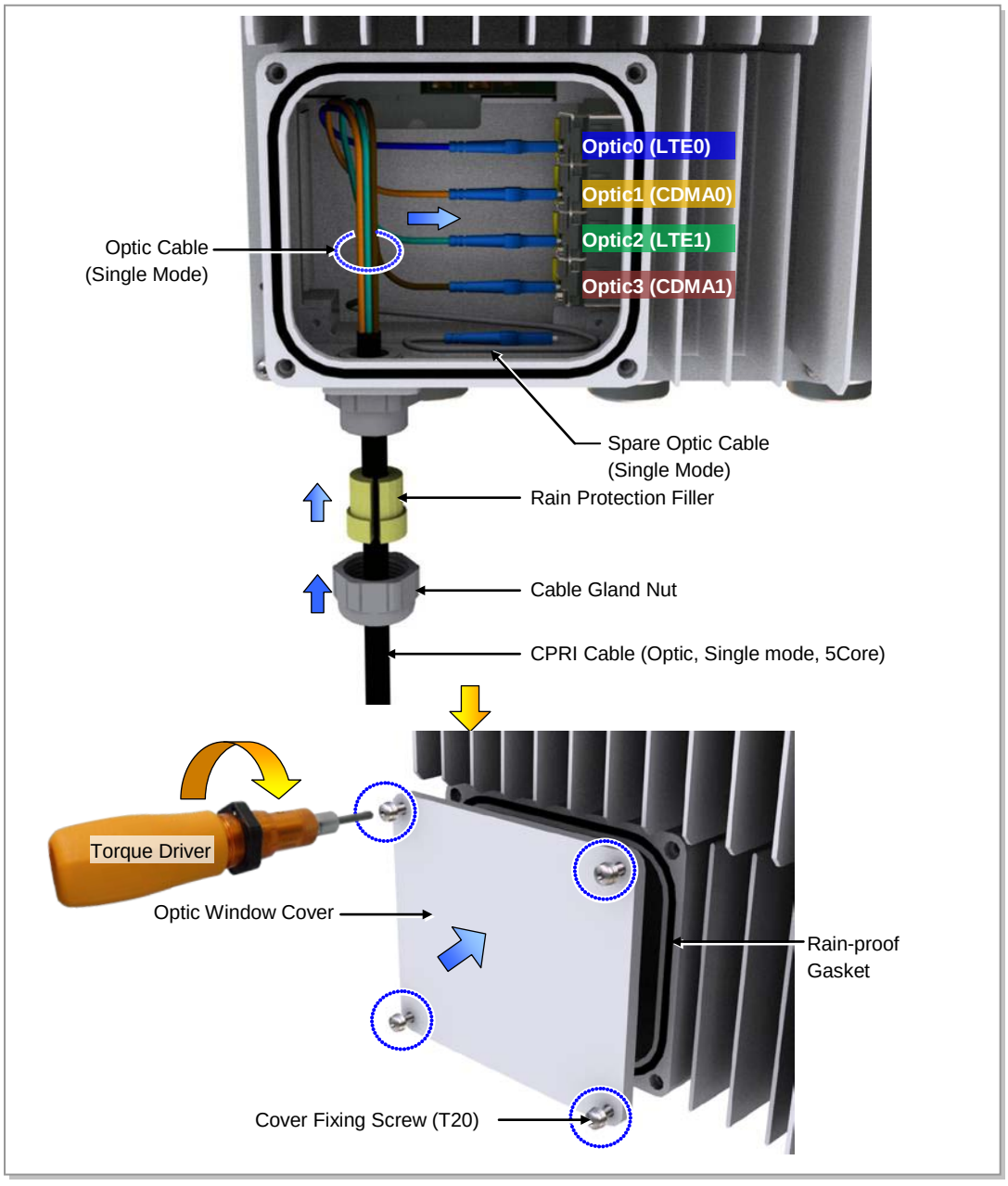


Figure 2.42 Connecting RRH-P4 CPRI cable (2)

CAUTION

Caution on Rain-proof Gasket Damage When Installing Window Cover

Be careful so as not to let the rain-proof gasket get damaged (broken or incorrectly positioned). Check whether the rain-proof gasket is damaged before closing the power window cover and the optic window cover.

If the rain-proof gasket is damaged, replace the system (RRH-P4) with a new one.

Table 2.5 CPRI Cable connection configuration

Cable Color	Blue	Orange	Green	Brown	Gray
Port	Optic 0 (LTE 0)	Optic 1 (CDMA 0)	Optic 2 (LTE 1)	Optic 3 (CDMA 1)	Spare

Table 2.6 CPRI cable connection standard-When CDMA DU Shelf is one

DU Shelf (in. DU Cabinet)	CPRI Port	Optic Cable	RRH-P4	
			Sector	Port
 Shelf ID#2 (LTE) DU Blank Shelf ID#0 (CDMA)	DU#2 L9CA_L0	Blue	α (RRH-P4 #0)	Optic0
	DU#2 L9CA_L1	Blue	β (RRH-P4 #1)	Optic0
	DU#2 L9CA_L2	Blue	γ (RRH-P4 #2)	Optic0
	DU#0 CIMA_L0	Orange	α (RRH-P4 #0)	Optic1
	DU#0 CIMA_L1	Orange	β (RRH-P4 #1)	Optic1
	DU#0 CIMA_L2	Orange	γ (RRH-P4 #2)	Optic1

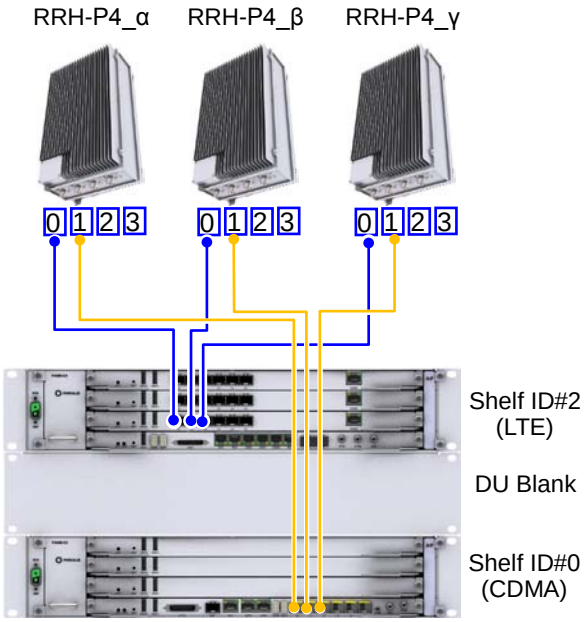
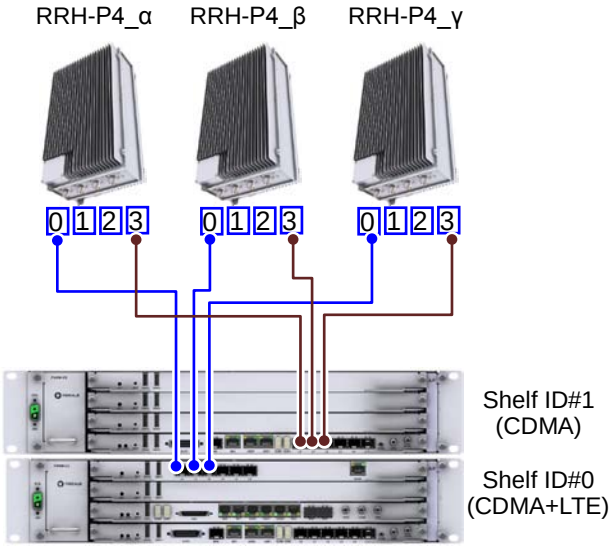


Table 2.7 CPRI cable connection standard-When CDMA DU Shelf is two

DU Shelf (in. DU Cabinet)	CPRI Port	Optic Cable	RRH-P4	
			Sector	Port
 Shelf ID#1 (CDMA) Shelf ID#0 (CDMA+LTE)	DU#1 CIMA_L0	Brown	α (RRH-P4 #0)	Optic3
	DU#1 CIMA_L1	Brown	β (RRH-P4 #1)	Optic3
	DU#1 CIMA_L2	Brown	γ (RRH-P4 #2)	Optic3
	DU#0 L9CA_L0	Blue	α (RRH-P4 #0)	Optic0
	DU#0 L9CA_L1	Blue	β (RRH-P4 #1)	Optic0
	DU#0 L9CA_L2	Blue	γ (RRH-P4 #2)	Optic0



Cautions When Connecting the CRPI Cable

Failure to observe the CPRI cable connection specified in Table 2.5 may impair the communication between the CDMA and LTE FDD terminal.

Caution for Laser Beam of Optical Module and Cable

The optical module and cable used in the system emit bright laser beams. Always handle them with care as there is risk of serious injury if the eyes are exposed to the laser beam of the optical cable.

RRH-P4 optic cable connection standard

Cable connection standard between UADU CPRI port and RRH-P4 optic port is different according to the count (One or two) of CDMA UADU (Installed in DU cabinet).

Connect the optic cable (Refer to the connection standard of ‘table 2.6’ and ‘table 2.7’). Because false connection can cause the fault of call connection, be cautious.

RRH-P4 Optic Cable

The optic cable consists of 5 cores. The grey cable is the spare cable for replacement in case one of the 4-core optic cables would fail.

2.8.5 Hybrid Cable Shield Grounding Connection

Follow the steps below to connect the shield ground cable of hybrid cable to the ground bar in the DU cabinet.

1) Install the shield ground cable of hybrid cable to the ground bar on the left of the DU cabinet.

2) Remove the M6 Hex. nuts and lock washers installed in the ground bar.

3) Align the pressure terminal assembled on the cable to the insert bolt of the ground bar, and fasten it using the removed M6 Hex. nut and lock washer.

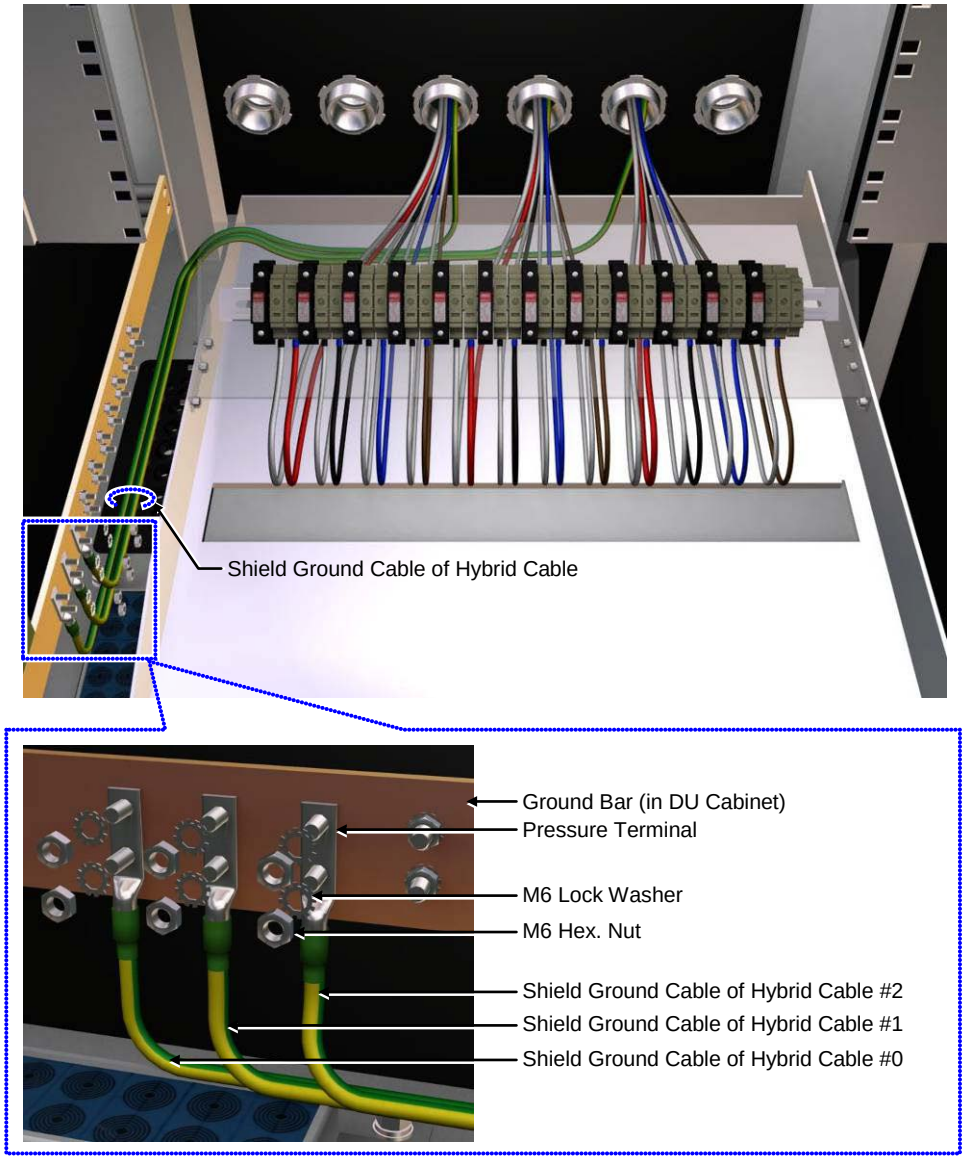


Figure 2.43 Hybrid Cable Shield Grounding Connection_DU Cabinet

Follow the steps below to connect the shield ground cable of hybrid cable to the tower ground bar.

1) Install the shield ground cable of hybrid cable to the tower ground bar where the RRH is installed.

2) Install the pressure terminal that meets the tower ground bar specifications to the connected ground cable.

3) Fix the pressure terminal installed to the cable to the tower ground bar.

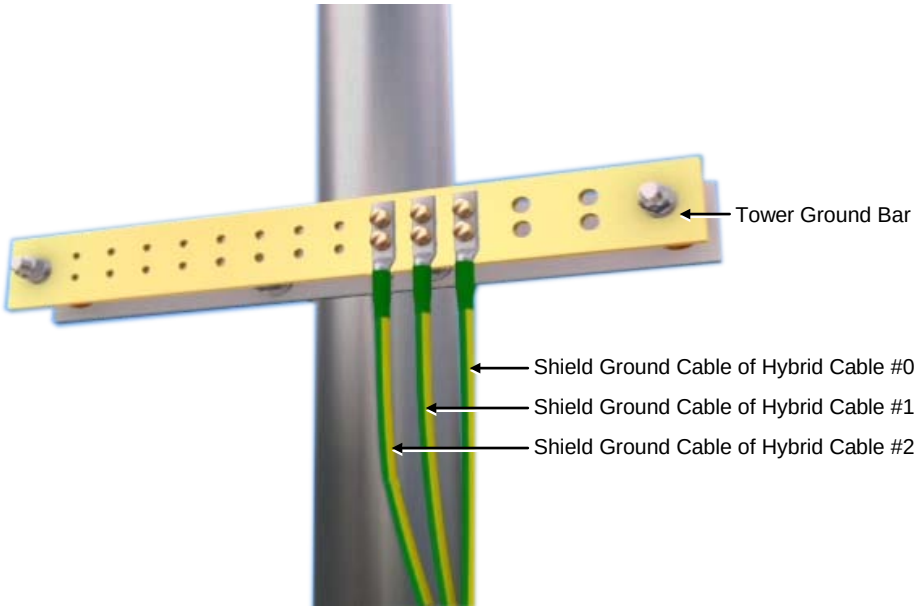


Figure 2.44 Hybrid Cable Shield Grounding Connection_Tower Ground Bar

2.8.6 Remaining Hybrid cable

Follow the steps below to organize the remaining cable after connecting the hybrid cable (power cable, CPRI cable) to RRH-P4.

1) Loop the excess length of the power cable and CPRI cable, and attach to the RRH-P4 fixing pole using a cable tie. Ensure to respect the optic cable's bending radius of (R=4.33 in./110 mm).

2) Bind the power cable and CPRI cable together with the feeder line using a cable tie.

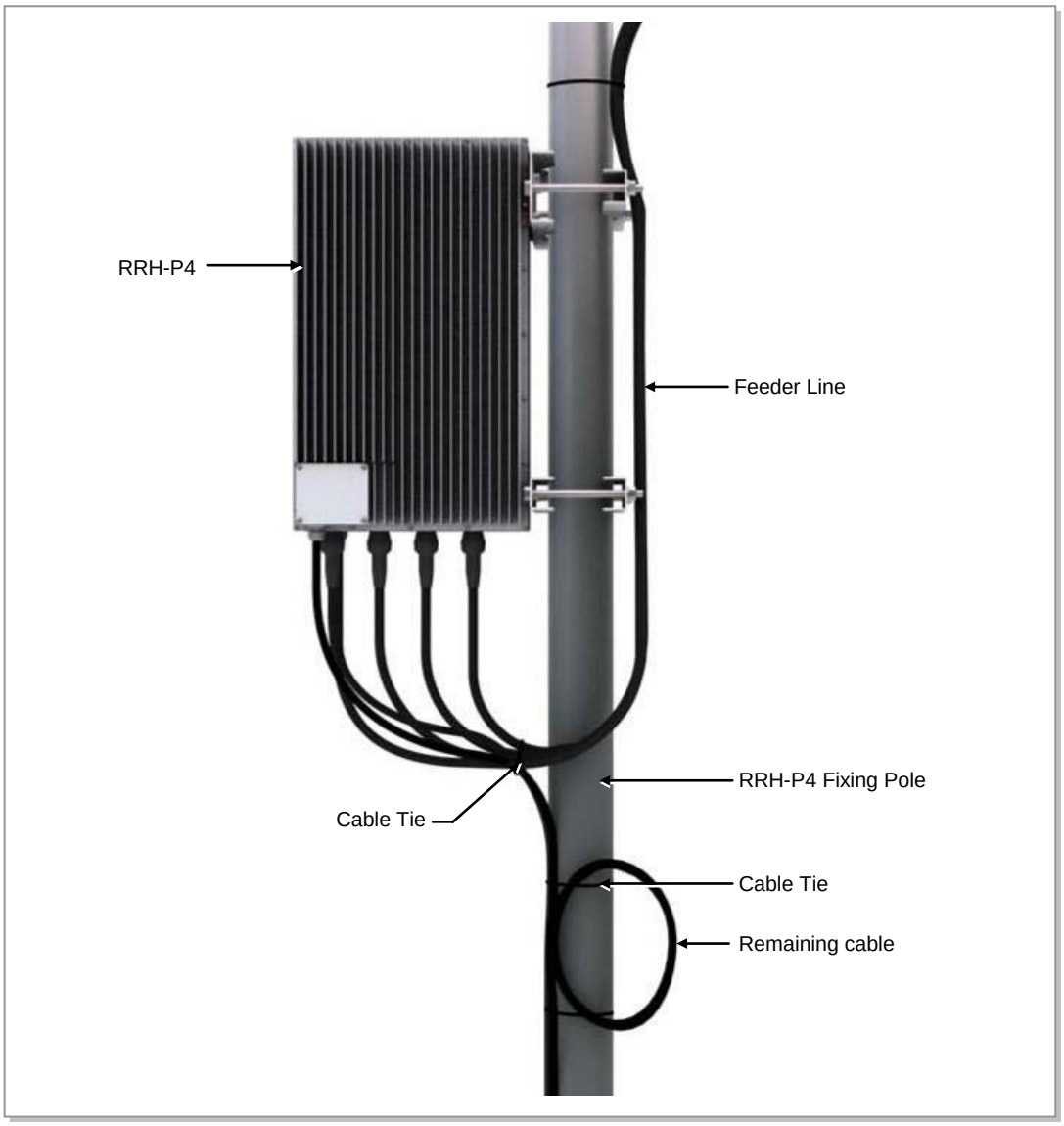


Figure 2.45 Remaining Hybrid cable (1)

3) Attach the junction box (breakout point) to the pole using a stainless steel band. Tie the cables to the pole 19.69 in. (500 mm) below and 19.69 in. (500 mm) above the box. (To stabilize the cables near the junction box's cable input and output holes.)

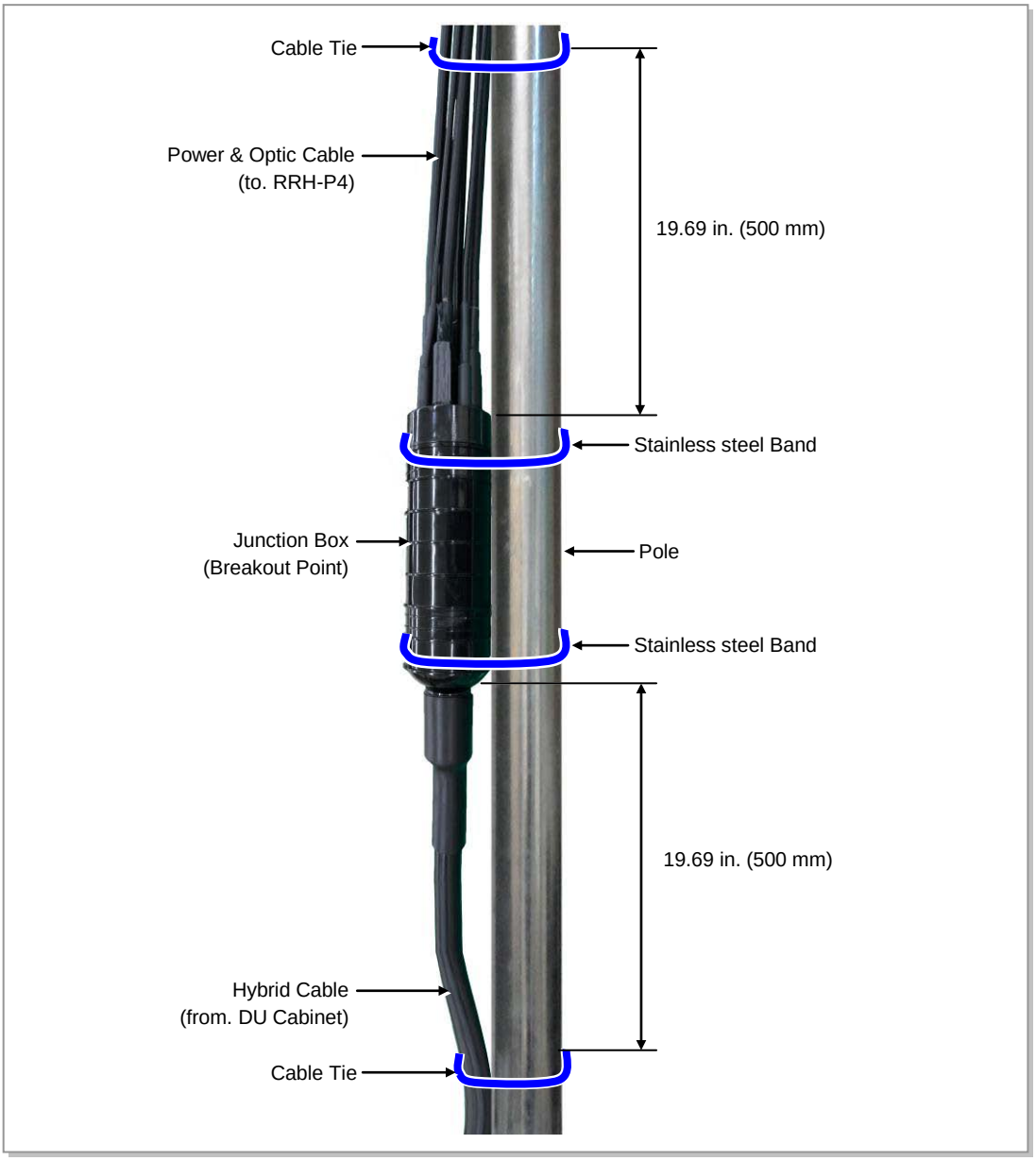


Figure 2.46 Remaining Hybrid cable (2)

4) Bind the spare cable to the pole with its waterproof cap facing up. Loop the remaining cable and bind it to the pole below the cap.

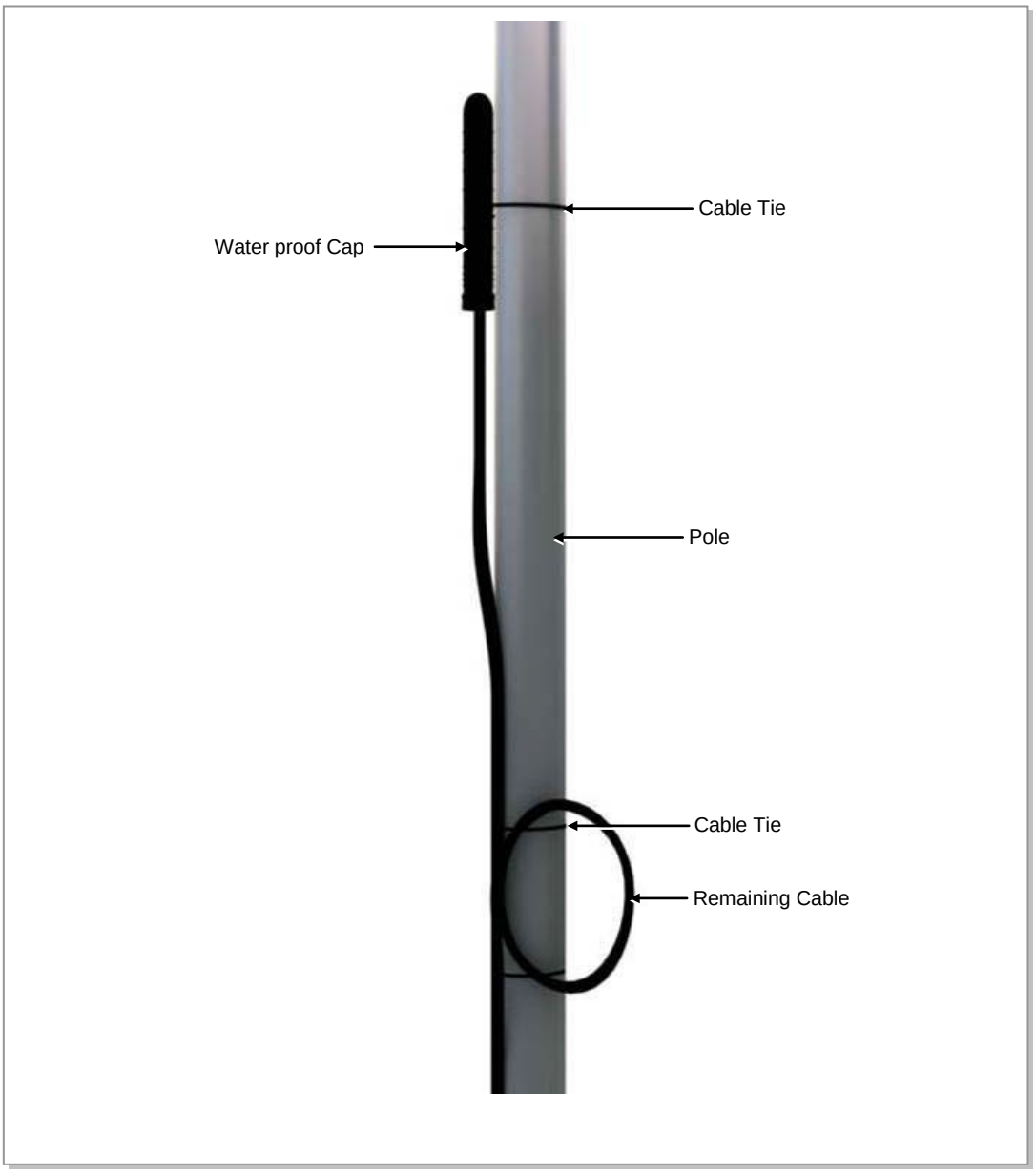


Figure 2.47 Remaining Hybrid cable (3)

2.9 Installation Test

If the installation of the system is complete, progress the installation test to check the status of the system. The purpose of this test is to remove problems, which may generate after the service starts, in advance for stable operation of the system. If there is any problem, restore the system and write out the failure table.

The installation test should be progressed in the order of power section test and function test.

Power Section Test

The power section test is progressed as follows:

1) Execute the 'off' of the breaker (RRH-P4 power in the DU cabinet is connected). Make sure that the DC resistance between the -48 V/RTN is over tens of kilo ohm (kΩ).
2) Make sure that the DC resistance between the RTN of Terminal block-① and RRH-P4 frame is no greater than 10 Ω. The ground cable must be installed at DU cabinet and RRH-P4
3) Execute the 'on' of the breaker (RRH-P4 power in the DU cabinet is connected). Make sure that the voltage between the RTN of terminal block-①, ② is over -40 V DC.
4) Execute the 'on' of the breaker (RRH-P4 power in the DU cabinet is connected). Verify that the LED (Red or green) in the RRH-P4 optic window is lit.
5) Turn off the breaker in the DU cabinet which is connected to the power of the RRH-P4.
6) Fasten the cover fixing screw (T20) using a Torque 0.87 lbf.ft (12.0 kgf.cm). Close the power window cover and the optic window cover.

Caution When Opening and Closing Power Window Cover

Make sure to turn off the breaker connected to the RRH-P4 power before opening or closing the power window cover of the RRH-P4.

If you open or close the power window cover when the breaker is turned on, it may cause damage to the system, or cause an electric short circuit resulting in severe injury.

Caution on Rain-proof Gasket Damage When Installing Window Cover

Be careful so as not to let the rain-proof gasket get damaged (broken or incorrectly positioned). Check whether the rain-proof gasket is damaged before closing the power window cover and the optic window cover.

If the rain-proof gasket is damaged, replace the system (RRH-P4) with a new one.

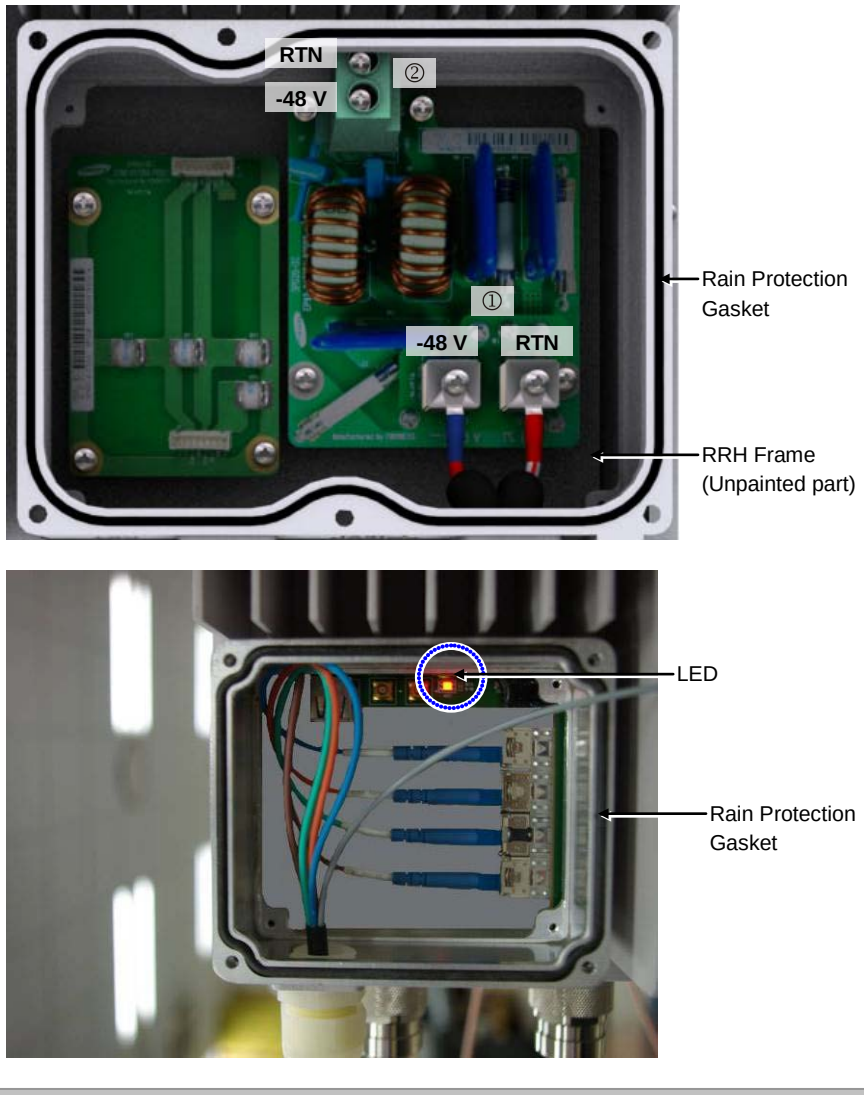


Figure 2.48 RRH-P4 Power Section Test

Table 2.8 Construction Status Checklist

Category	Check Items	Criteria	Result		Remarks
			Pass	Fail	
System Installation	System fixing status (Vertical and horizontal)	Horizontal and vertical locations			
	System arrangement status	Horizontal and vertical locations			
	Locking status and standard compatibility of bolts/nuts/washers	Visual inspection and magnet test			
	External wiring and other wirings	Visual inspection for twist, array and arrangement			
	System cable installation status	Checking twist, distortion and installation status			
	External connector connection	Visual inspection to check poor contact (Tightening status)			
	Other appurtenant work (Cable duct installation and others)	Visual inspection			
Power Acceptance	Equipment's power cable specification	Visual inspection			
	Rectifier ↔ System	Visual inspection			
	Cabling Status	Visual inspection for twisted or entangled status			
	Damage of cable sheath	Visual inspection			
	System power connector	- Visual inspection to check whether the power connector is connected normally without separation. - Inspection for the power connector shaking status			
	System input voltage (BATT voltage)	Measurement by digital meter (voltmeter)			
External interface	Optic Cabling Status	Visual inspection			
Ground Construction	Ground line standard	Visual inspection			
	Ground bar ↔ System	Visual inspection			
	Ground line cabling status	Cabling status check			
	Termination treatment of the ground line (Pressure Terminal)	Visual inspection			

Table 2.8 Construction Status Checklist (continued)

Category	Check Items	Criteria	Result		Remarks
			Pass	Fail	
Feeder Line status	Feeder Line installation and fixing status	View, consistency, bending			
	ANT installation and connection status	Visual inspection (ANT stick shaking status)			
	Connection and end processing status	View, consistency			
Various TAG Status	Feeder Line tag	Visual inspection (Content: Length, LOSS value, position)			
	Power cable tag	Visual inspection			
	Ground table tag	Visual inspection			
	Attachment status of the label for the real-name construction system - Indoor: wall side of the gate side - Outdoor: inside of the cover of the distribution box	Visual inspection (size, material, etc.)			
	Cable duct, bolt connection status	Visual inspection			
	Feeder line Entrance end processing status (Outdoor)	Visual inspection (Checking back side Connection)			
	Status of inside/outside of the system and vicinity of the base station	Visual inspection			
General Opinion					

This page is intentionally left blank.

ANNEX A. Sector Antenna Installation

A.1 Cautions when Installing a Sector Antenna

Precautions of antenna installation are as follows.

- Sector antennas should be installed vertically. (±1°)
- Antenna is the precise material, so be careful not to make damage or form change.
- When moving antenna, use the tool suitable to rating. In addition, use the rated carrying device which is at least 200 % or more than antenna considering the stability.
- Be careful not to give too much strength to the antenna.
- If it rains, suspend connecting the feeder cable and antenna.
- Fix it after adjusting the direction of antenna exactly.
- Distance between steel tower and antenna and the distance between send-receive antennas are based on the antenna layout.
- Attach the antenna on the position specified in the drawing.
- Install the antenna not to make a feature change of the antenna considering the direction of the radiation
- When connect the connector to the antenna, not making the alien substance flowed and is not under the influence of PIMD.
- Measure VSWR of all antennas and the value should be within the regulated value.

A.2 Sector Antenna Layout

The method of sector antenna layout is as follows.

1) Use the transit to adjust the antenna installation direction exactly.
2) Fix the direction of the sector antenna, same as the angle settled when designing the cell after installing the steel tower.
3) Arrange the antennas of each sector to the sector directional angle at right angles by adjusting the distance between antenna and steel tower.
   In the event of the station whose the direction between sectors is not 120°, install it to make the steel tower and antenna direction different being careful of the tilt and azimuth.
4) For circular platform, separate the antenna interval at maximum.

A.3 Sector Antenna Installation

The method of sector antenna installation is as follows.

1) Put up an antenna pole and insert the sector antenna into the antenna pole using a fixing clamp.
2) Set the antenna's up/down tilt to 0° and fix the fixing clamps at the top and bottom.
3) After tightening the fixing clamp, adjust the antenna up/down (tilt) depending on the signal strength. The bolt of the guide clamp must be loosened, so the antenna angle can be adjusted.
4) After setting the antenna angle, fasten the bolt of the guide clamp, which was loosened previously. Regarding the nut, the double nut mounting should be used to prevent the nut from coming loose.

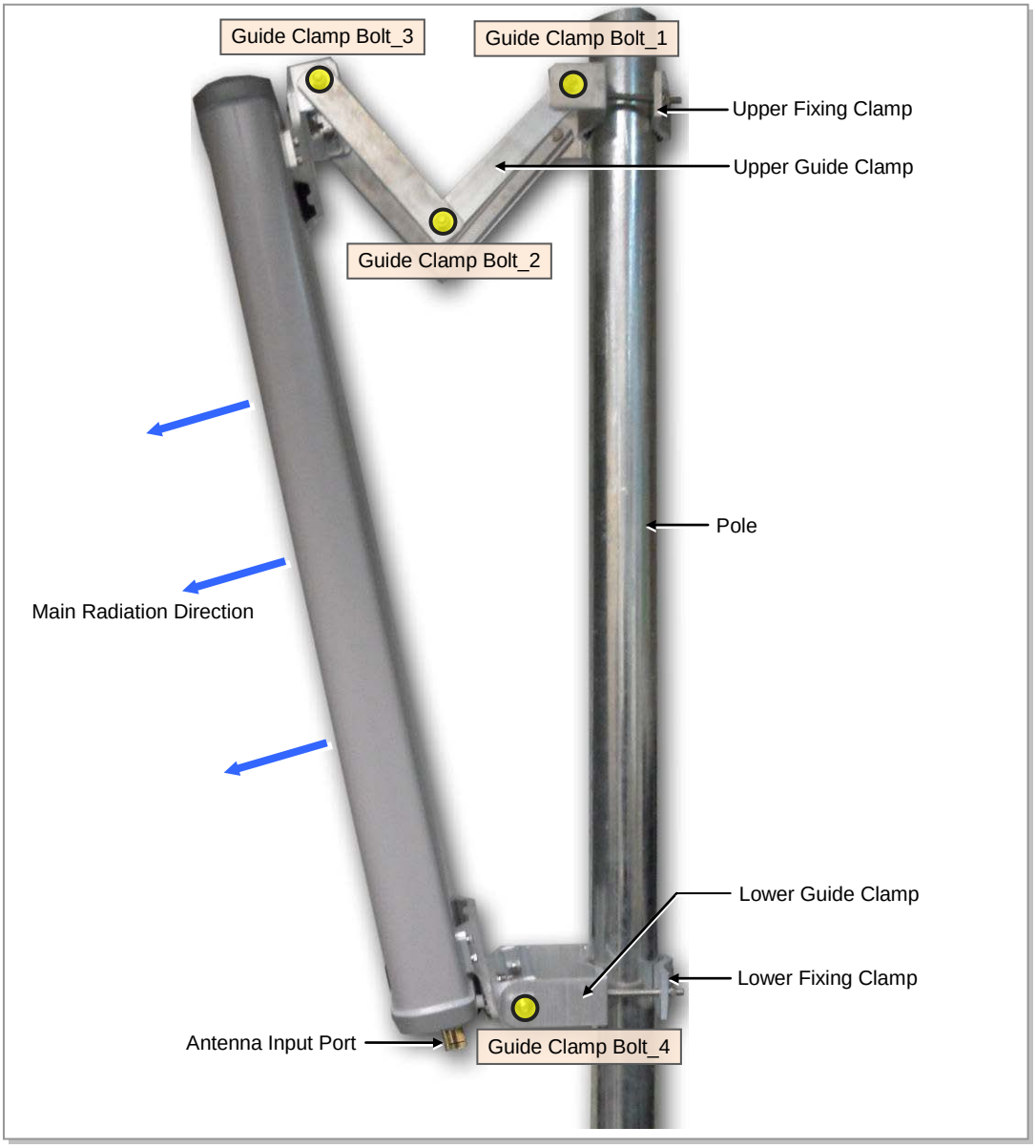


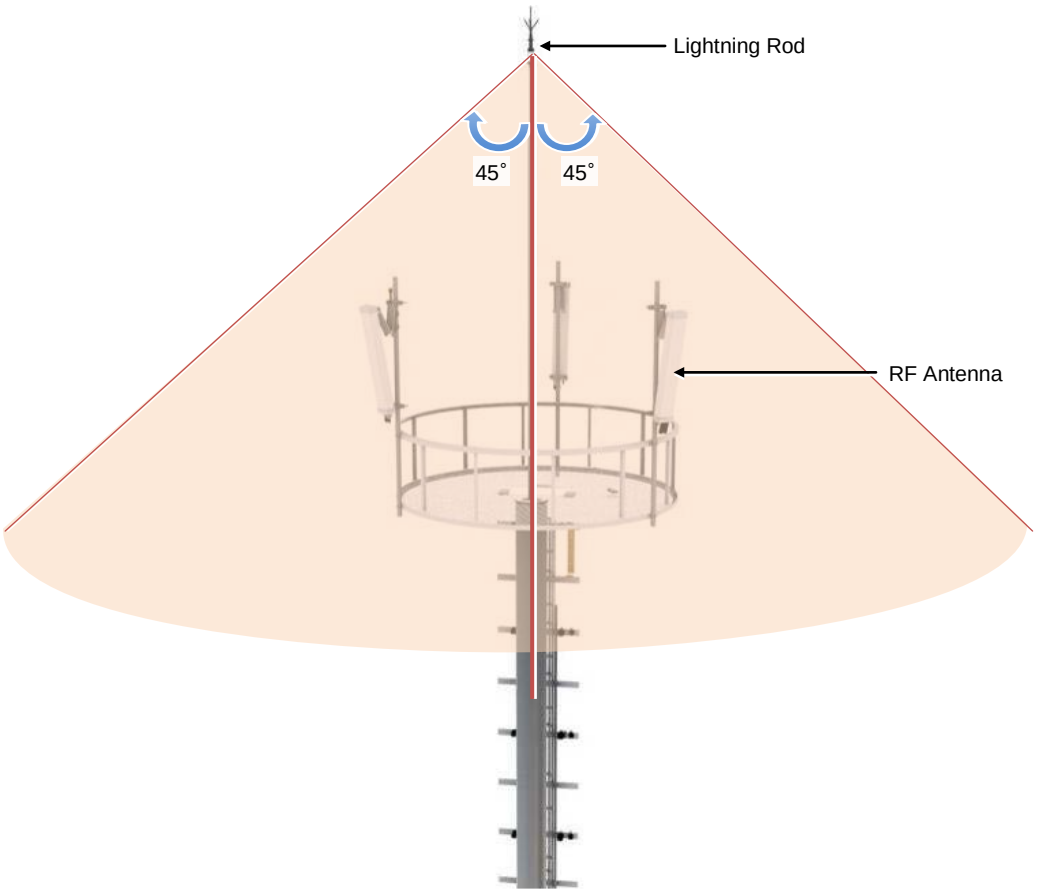
Figure A.1 Sector Antenna

CAUTION

Caution when Installing the RF antenna

To protect from lightning, the RF antenna must be installed within the shielding angle as shown below, considering the downward distance and the angle from the tower lightning rod or the antenna pole lightning rod.

- The protection angle of the lightning rod should be 45 degrees.



This page is intentionally left blank.

ANNEX B. Feeder Line Work

B.1 When installing the feeder, the cautions

When installing the feeder, the following cautions shall be considered:

- Put a plate to work not to make damage for the surface of the feeder cable.
  If there is external damage of the feeder cable, cut the damaged part and work wiring.
- After connecting the antenna to the feeder cable, finish the connection part of the contracted pipe using the contracted tube.
- Attach the cognitive tapes to the both ends of the feeder cable, which makes it easy to recognize.
- When connecting cabinet, antenna and lightening arrestor, etc. to the feeder cable, connect strongly to prevent from generating reflected wave.
- The curvature radius should be maximized, keep the minimum curvature radius.

Table B.1 Curvature Radius of Feeder Cable for Outdoor

Specification			Allowed Radius of Curvature	Remark
LS Feeder Line	HFC-12D	1/2 in.	4.02 in. (125 mm)	Outdoor
	HFC-22D	7/8 in.	9.84 in. (250 mm)	
	HFC-33D	1-1/4 in.	14.96 in. (380 mm)	
	HFC-42D	1-5/8 in.	20.08 in. (510 mm)	
RFS Feeder Line	LCF12-50	1/2 in.	4.92 in. (125 mm)	
	LCF78-50	7/8 in.	9.84 in. (250 mm)	
	LCFS114-50	1-1/4 in.	14.96 in. (380 mm)	
	LCF158-50	1-5/8 in.	19.69 in. (500 mm)	

Table B.2 Curvature Radius of Feeder Cable for Indoor

Specification			Allowed Radius of Curvature	Remark
LS Feeder Line	HFSC 6D	1/4 in.	0.98 in. (25 mm)	Indoor
	HFSC 10D	3/8 in.	0.98 in. (25 mm)	
	HFSC 12D	1/2 in.	1.26 in. (32 mm)	
	HFSC 22D	7/8 in.	4.92 in. (125 mm)	
RFS Feeder Line	SCF14-50	1/4 in.	0.98 in. (25 mm)	
	SCF38-50	3/8 in.	0.98 in. (25 mm)	
	SCF12-50	1/2 in.	1.26 in. (32 mm)	
	UCF78-50	7/8 in.	4.92 in. (125 mm)	

Table B.3 Curvature Radius of LMR-400 (Based on Times Microwave system)

Specification	Allowed Radius of Curvature	Remark
LMR-400	1 in. (25.4 mm)	Installation
	4 in. (101.6 mm)	Repeated

CAUTION

Radius of Curvature of Feeder Line

When installing a feeder line, the radius of curvature of the sections where cables bent should be larger than the allowed radius of curvature. If the radius of curvature for the feeder line installation is less than the allowed radius of curvature, it may affect the performance of the system.

- Ensure that the feeder cable does not interfere with steel towers, ladders and in the areas chiefly used by people.
- Connect the connector to the antenna in a straight line and after connecting, do not apply excessive force.
- Use the vinyl tape for electricity and heat shrink tube for the external exposed part of the connector not to avoid leak water.
- Wind the self-bonding rubber tape overlapping (keep a distance as the half size of rubber tape) to the connector connection part and wind the vinyl tape for electricity to the 2 times or more and then cover with the heat shrink tube.

Connection of Feeder Cable Connector

Connecting the feeder cable connector is critical process, so the qualified workers who finished the related education should perform.

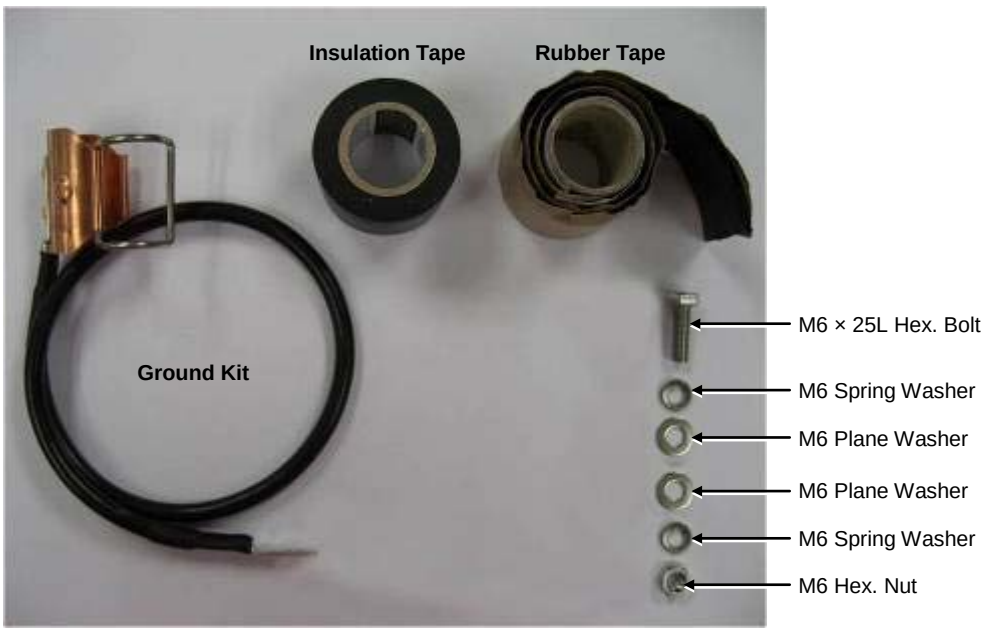
Table B.4 Connector Connection Torque Value

Connector	Torque Value
SMA connector	0.18 lbf·ft (2.5 kgf·cm)
TNC connector	0.65 lbf·ft (9 kgf·cm)
N-type connector	1.45 lbf·ft (20 kgf·cm)
Din-type connector	14.46 lbf·ft (200 kgf·cm)

B.2 Antenna Feeder Cable Ground

Ground the antenna feeder line using the grounding kit located under the Tower Ground Bar (TGB) installed in the lower section of the tower or in the antenna feeder line duct.

The way to connect the ground kit of feeder is as follows:



1) Remove about 55 mm of the sheath of cable when the 2.17 in. (55 mm). feeder cable is used.

2) Open it by returning hook of the clamp fixing for Ground kit in the left direction.

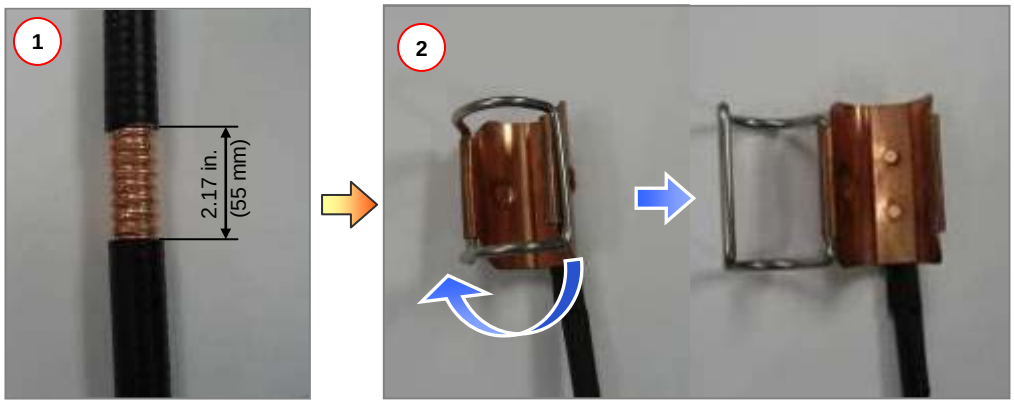


Figure B.1 Feeder Cable Grounding (1)

3) Insert the ground kit clamp into the place from which the feeder line sheath is removed.

4) Pull the clamp lock to the upward so that the lock can be hung on the global protrusion area on the side.

5) Overlap the exposed part of the ground kit clamp using rubber tape (Keep a distance as the half size of rubber tape) and press it with your hands lightly to make rubber tape adhere well.

6) Wrap the part where the rubber tape is attached using insulation tape two times or more. When cutting off the tape, cut it off neatly using a cutting device such as scissors or a knife.

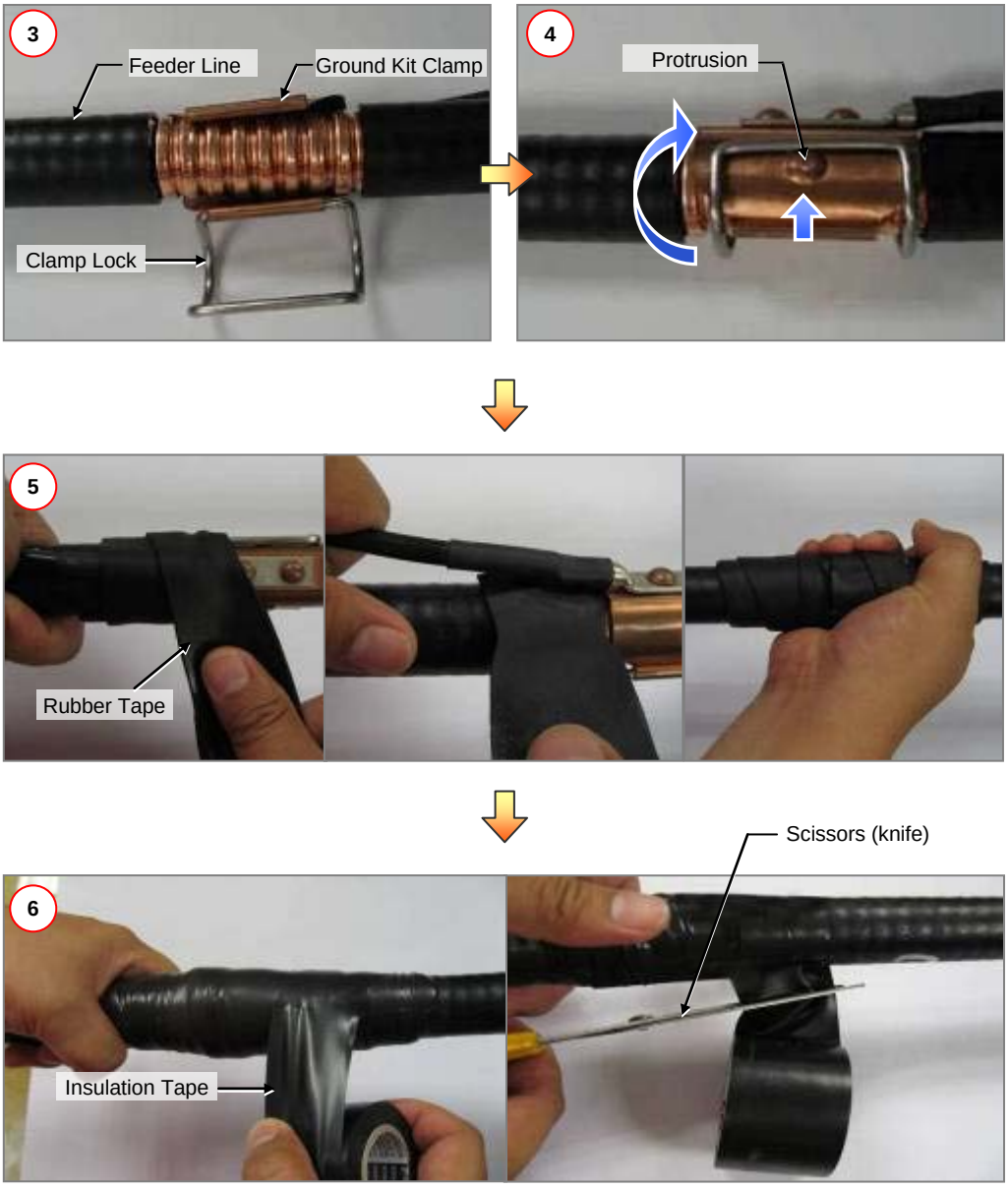


Figure B.2 Feeder Cable Grounding (2)

7) Align the heat shrink tube, inserted when installing the feeder line, into the fixing part of the ground kit.
- Heat shrink tube: Φ 1.65 in., 7.87 in (Φ 42 mm, 200 mm)

8) Shrink the heat shrink tube [jelly type, 7.87 in. (200 mm)] by heating gun.

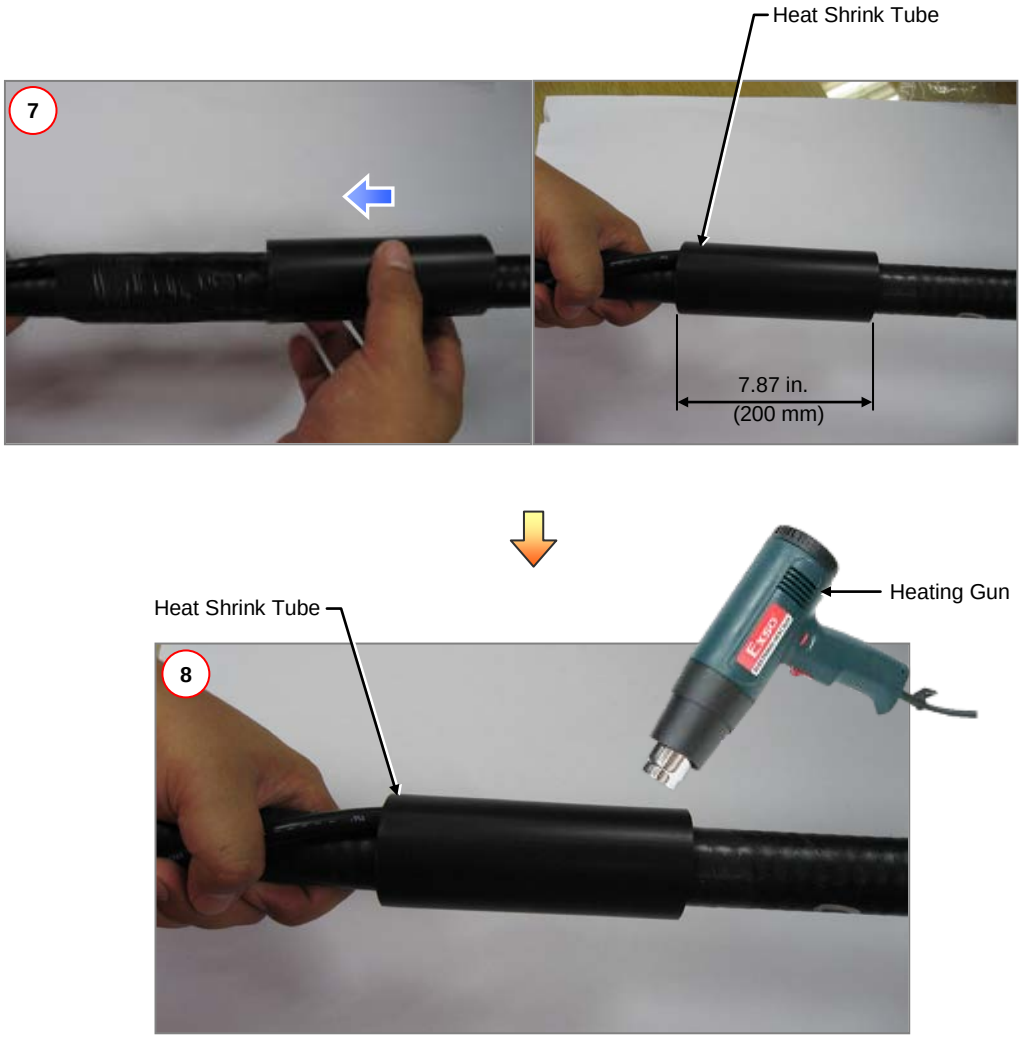


Figure B.3 Feeder Cable Grounding (3)

9) After the ground kit has been installed to the feeder line, attach the pressure terminal (1 hole) of the ground cable connected to the ground kit to the TGB.

10) When attaching the pressure terminal, use M6 × 25L hex. Bolts.

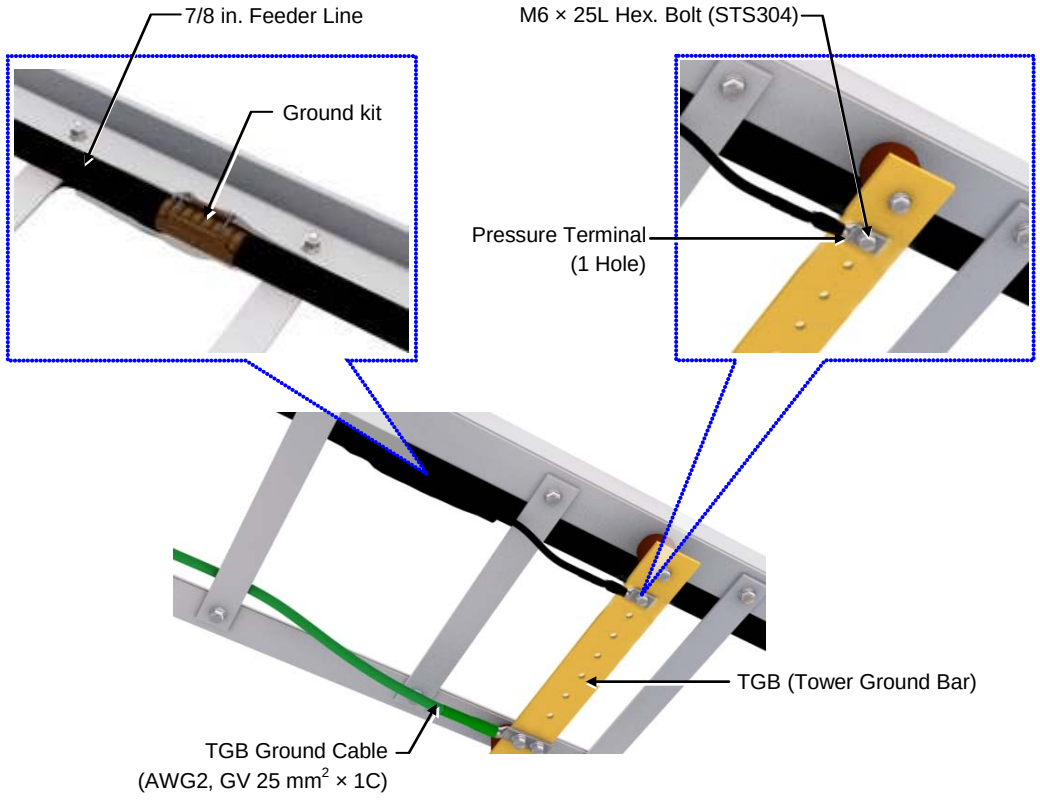


Figure B.4 Feeder Cable Grounding (4)

CHECK

Check Ground Kit and TGB Specifications

The specifications, clamp, and pressure terminal type of the ground kit and TGB differ depending on manufacturers. Make sure to check the specifications of the ground kit and TGB, and identify the installation method before installing it.

Table B.5 TGB Installation Example

Category	Description
TGB Usage	Earth terminal board for feeder cable for grounding in using the feeder cable of more than 7/8 in.
TGB Location	Lower section of cable rack in feeder cable duck - less than 65.62 ft (20 m): 1 (Ex. steel tower lower section) - more than 65.62 ft (20 m): 2 (Ex. steel tower lower and upper section)
Material	Pure copper
Installation Method	Using the insulator to separate from the steel tower electrically
Connection Method	Extract the AWG2, GV 25 mm² ground cable to the direction of the floor and weld it to the tower's ground cable.

B.3 Tower Ground Construction

1) Install a Tower Ground Bar (TGB) that will be used to ground a feeder cable onto the tower. If the height of the tower is more than 65.62 ft (20 m), two or more TGBs should be installed (onto the lower and upper sections of the tower). If the tower is 65.62 ft (20 m) or less, one TGB should be installed. Since the TGB installation location and the number of TGBs to be installed can differ depending on the system environment and provider's standards, consult your service provider.
2) Each TGB should be grounded and separated from other grounds. If there is an existing ground bar or ground cable for TGB, install the TGB by branching from it using a ground cable (AWG2, GV 25 mm^2 × 1C) ground cable.
3) Fasten the Ground Kit (feeder cable grounding assembly) to the TGB ground terminal and the tower hole using the pressure terminal hole attached at the end of the ground kit's ground cable.

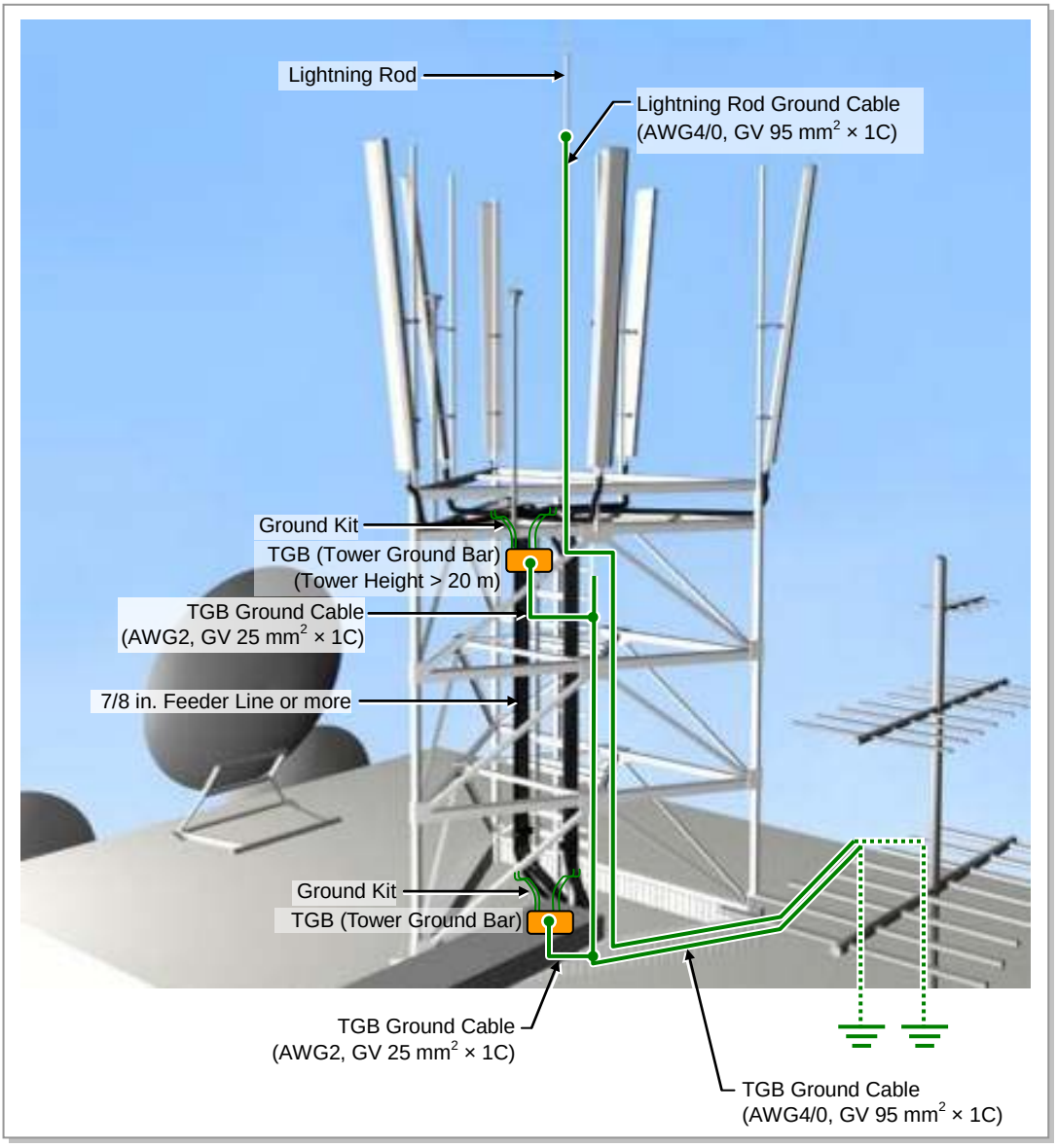


Figure B.5 Connecting the Tower Ground Cable

This page is intentionally left blank.

ANNEX C. Assembling connector

C.1 RJ-45 (Shield type)

Below is the method for assembling the RJ-45 (Shield type) connector.

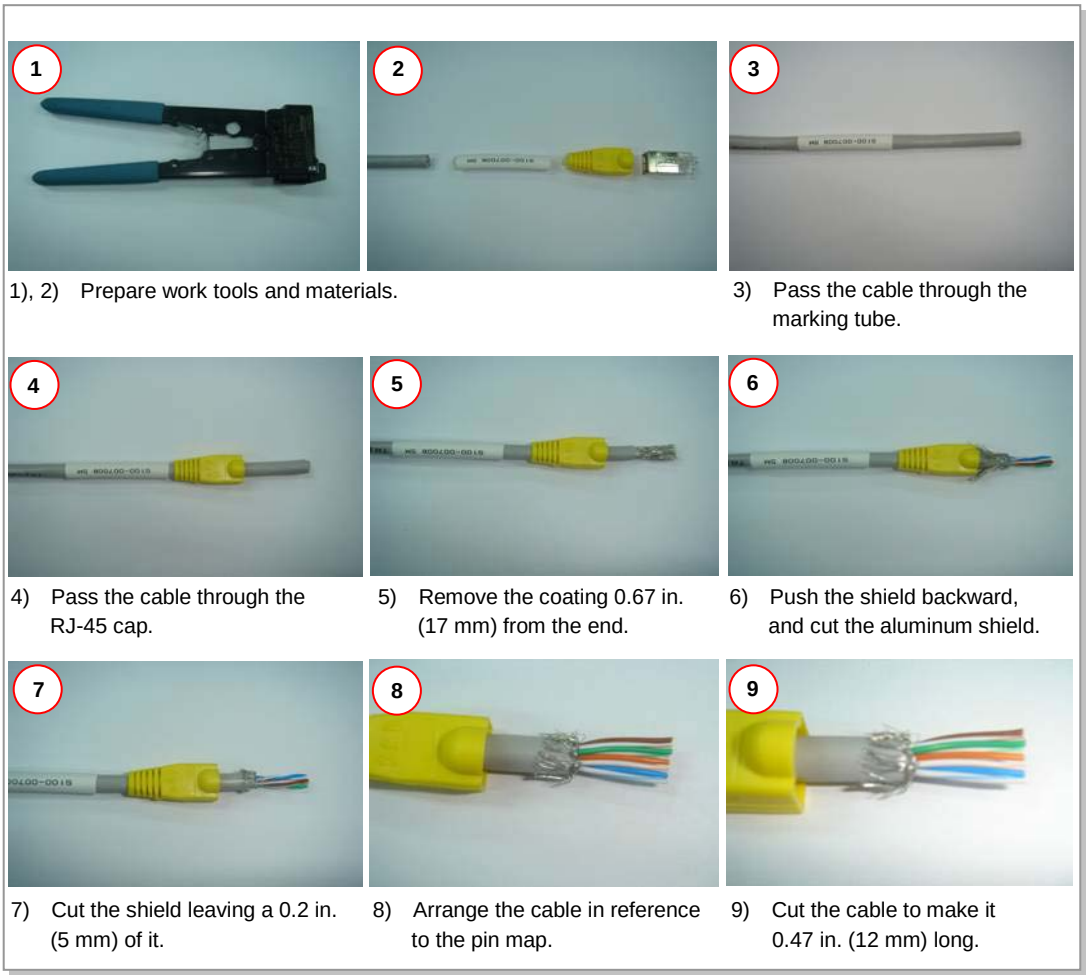
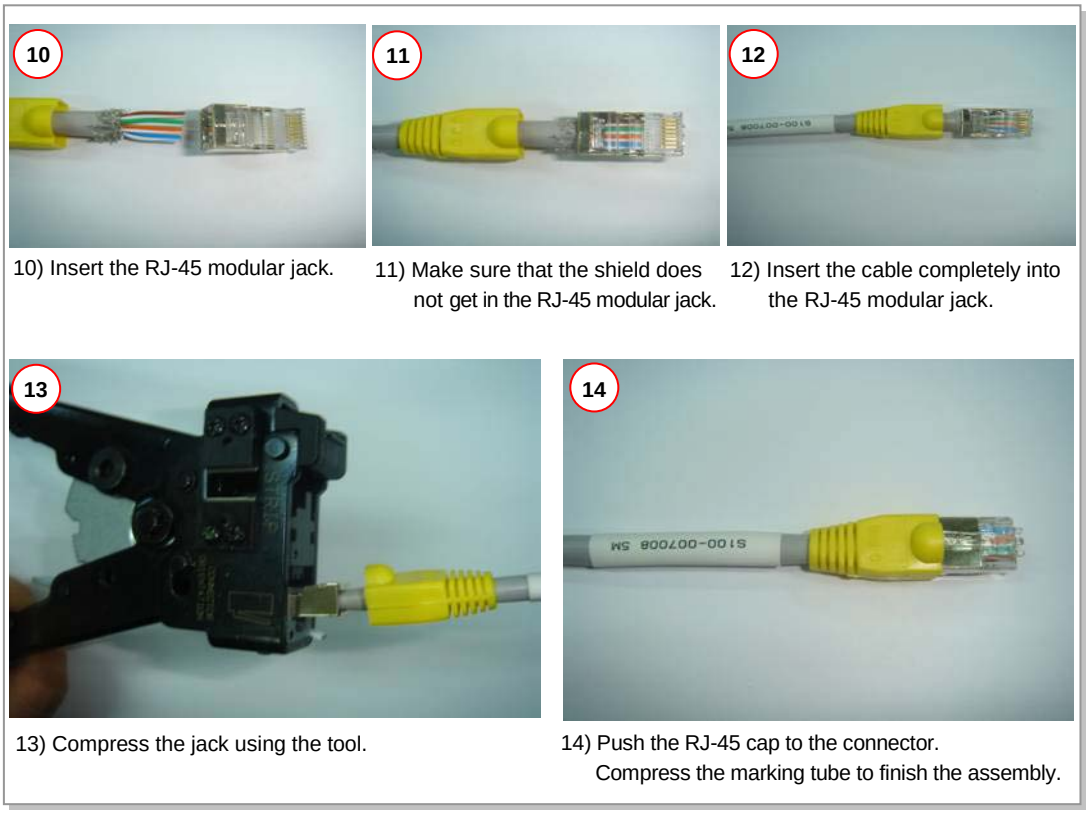


Figure C.1 Assembling the RJ-45 Connector (Shield Type) (1)



10) Insert the RJ-45 modular jack.

11) Make sure that the shield does not get in the RJ-45 modular jack.

12) Insert the cable completely into the RJ-45 modular jack.

13) Compress the jack using the tool.

14) Push the RJ-45 cap to the connector. Compress the marking tube to finish the assembly.

Figure C.2 Assembling the RJ-45 Connector (Shield Type) (2)

C.2 RJ-45 (Normal type)

Below is the method for assembling the RJ-45 (Normal type) connector.

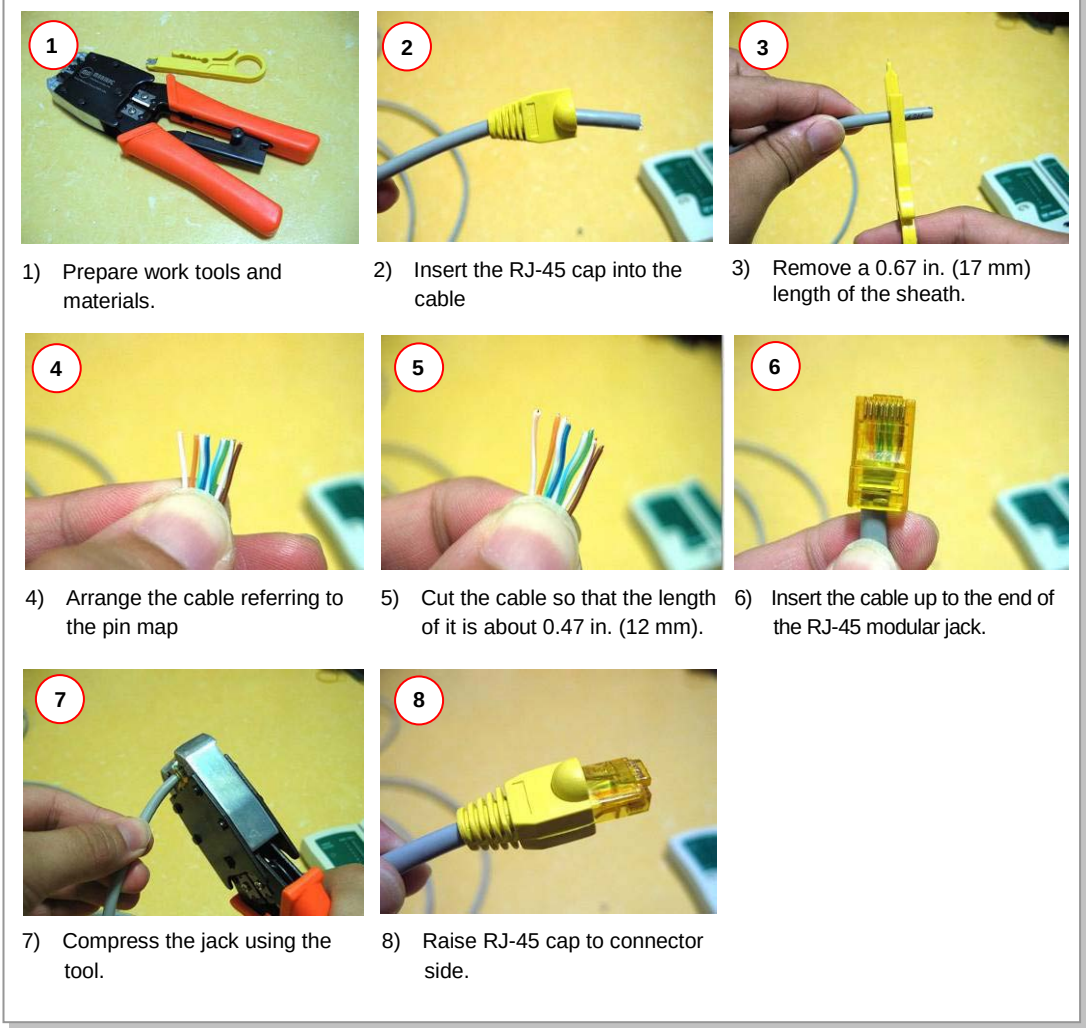
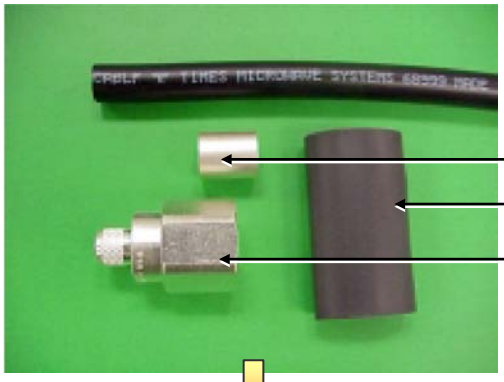


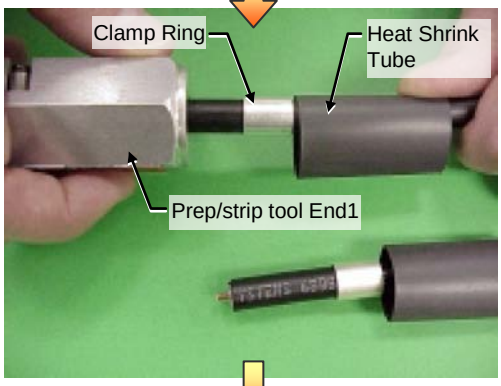
Figure C.3 Assembling the RJ-45 connector (Normal type)

C.3 N type-male (LMR-400)

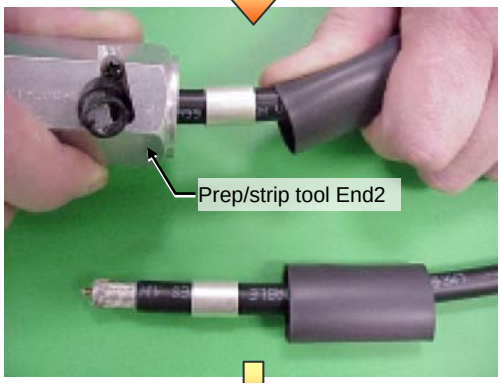
Below is the method for assembling the N type-male connector to the LMR-400 cable.



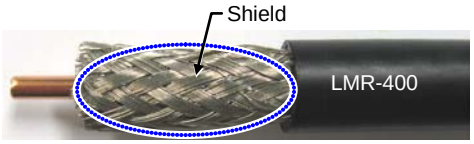
1) N type-male connector consists of the N type-male body, clamp ring, and heat shrink tube.

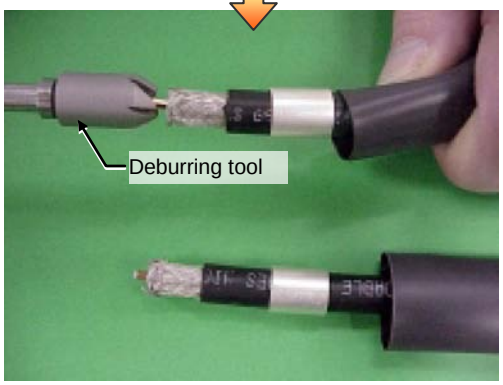


2) Insert a heat shrink tube and clamp ring to the cable; insert the cable to the 'End1' of the prep/strip tool, and remove the shield and sheath except for the center conductor at the end of cable by rotating the tool clockwise.



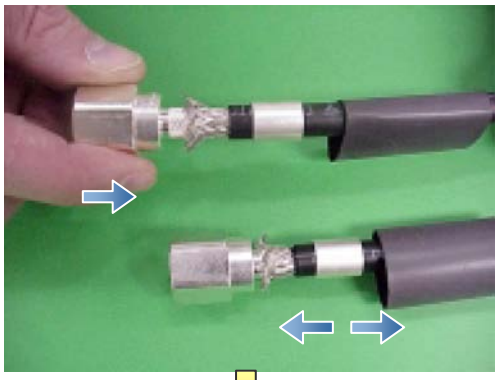
3) Insert the cable to the 'End2' of the prep/strip tool again, and remove the sheath by rotating the tool.



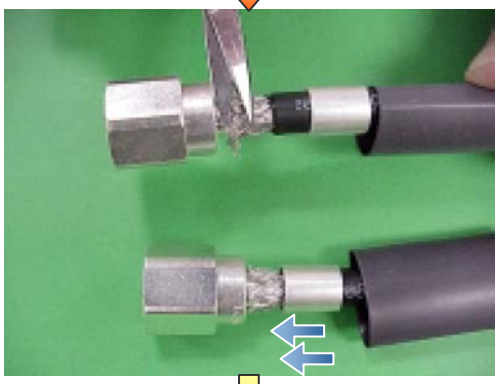


4) Trim the end of the center conductor by using a deburring tool.

Figure C.4 Assembling the N type-male connector (LMR-400) (1)



5) Push the N Type-male body into the end of the cable until it is solidly inserted to the pin connection part of the N Type-male body. Make the shield overlap over the N Type-male body. Then pull out the clamp ring and reset it to the original position to make the remaining shield folded.



6) Cut off the folded remaining shield using a cutting device so that it does not protrude outside when the clamp ring is inserted.
After arranging the shield, push up the clamp ring toward a connector until the entire shield is covered.

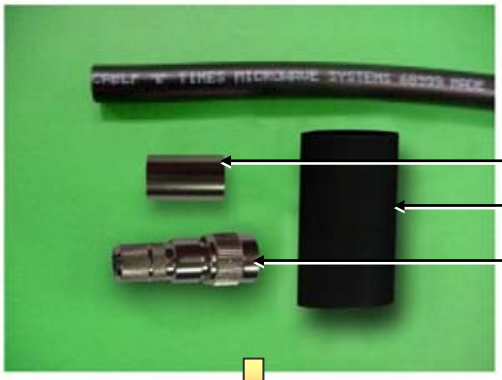
7) Using a compressor and hexagonal dies, pressurize the clamp ring to fix the cable and connector.

8) Lift the heat shrink tube up to the connection point on the connector, and shrink the heat shrink tube using a heating gun.

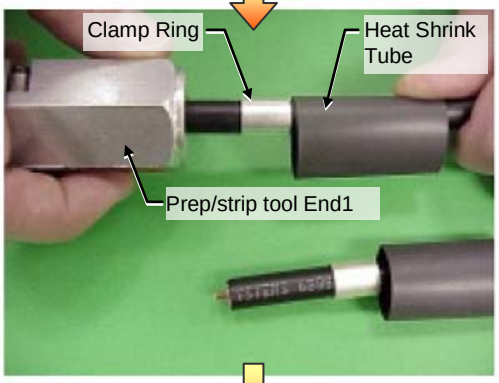
Figure C.5 Assembling the N type-male connector (LMR-400) (2)

C.4 TNC-male (LMR-400)

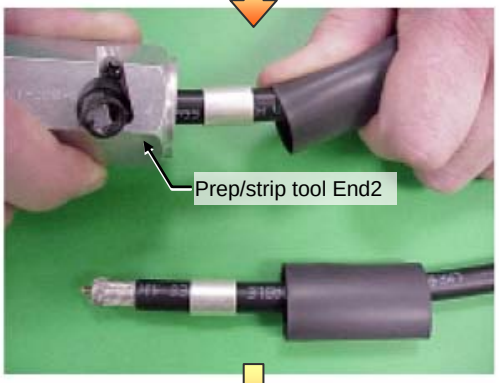
Below is the method for assembling the TNC-male connector to the LMR-400 cable.



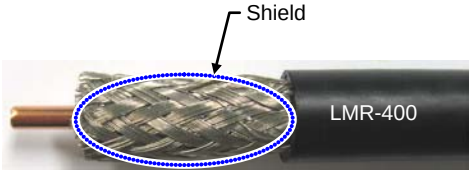
1) The TNC male connector consists of the TNC male body, clamp ring, and heat shrink tube.

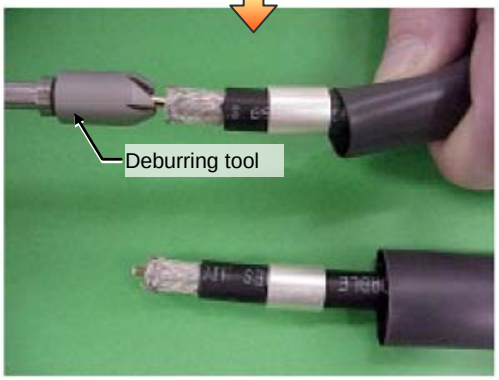


2) Insert a heat shrink tube and clamp ring to the cable; insert the cable to the 'End1' of the prep/strip tool, and remove the shield and sheath except for the center conductor at the end of cable by rotating the tool clockwise.



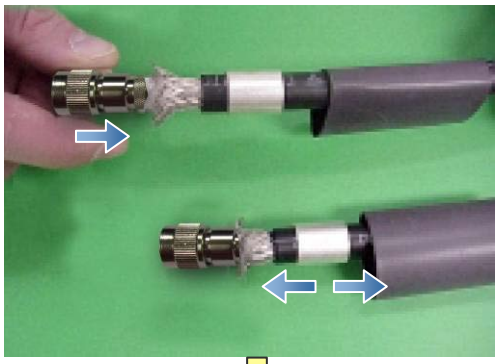
3) Insert the cable to the 'End2' of the prep/strip tool again, and remove the sheath by rotating the tool.





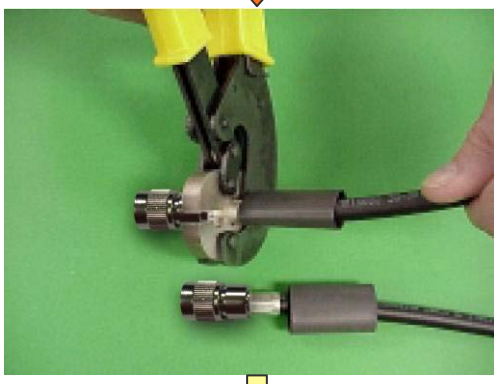
4) Trim the end of the center conductor by using a deburring tool.

Figure C.6 Assembling the TNC-male connector (1)



5) Push the TNC male body into the end of the cable until it is solidly inserted to the pin connection part of the TNC male body. Make the shield overlap over the TNC male body. Then pull out the clamp ring and reset it to the original position to make the remaining shield folded.

6) Cut off the folded remaining shield using a cutting device so that it does not protrude outside when the clamp ring is inserted.
After arranging the shield, push up the clamp ring toward a connector until the entire shield is covered.



7) Using a compressor and hexagonal dies, pressurize the clamp ring to fix the cable and connector.

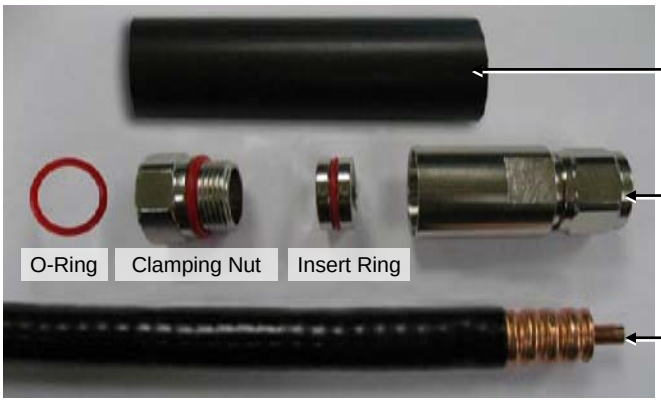
8) Lift the heat shrink tube up to the connection point on the connector, and shrink the heat shrink tube using a heating gun.

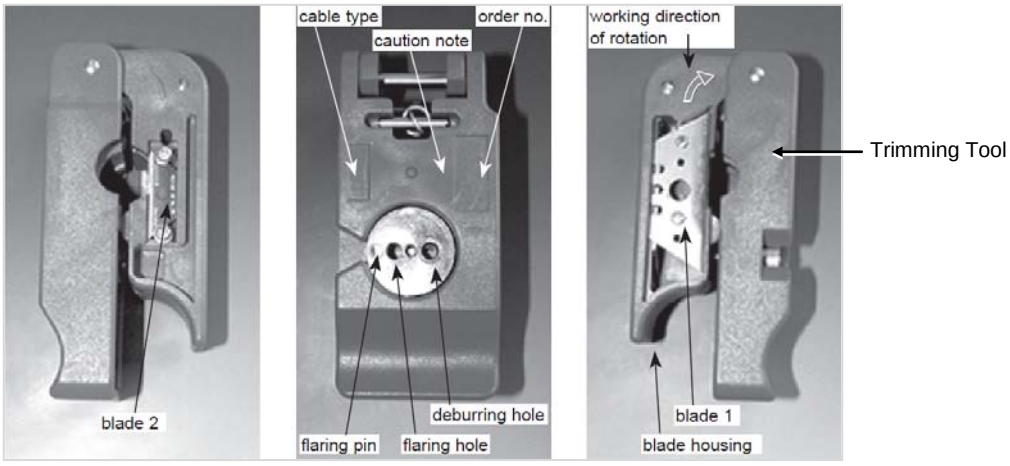
Figure C.7 Assembling the TNC-male connector (2)

C.5 N type-male (1/2 in. feeder line)

Below is the method for assembling the N-type-male connector to the 1/2 in. feeder line.

1) The components of the N type-male are an N type-male body, an insert ring, a clamp nut, O-ring, and a heat shrink tube, and it is assembled using the wire stripper, trimming tool, spanner, etc.





2) Using a stripping tool or a knife, strip the 1/2 in. feeder line by 1 in. (25.4 mm) from the end, as shown in the figure below.

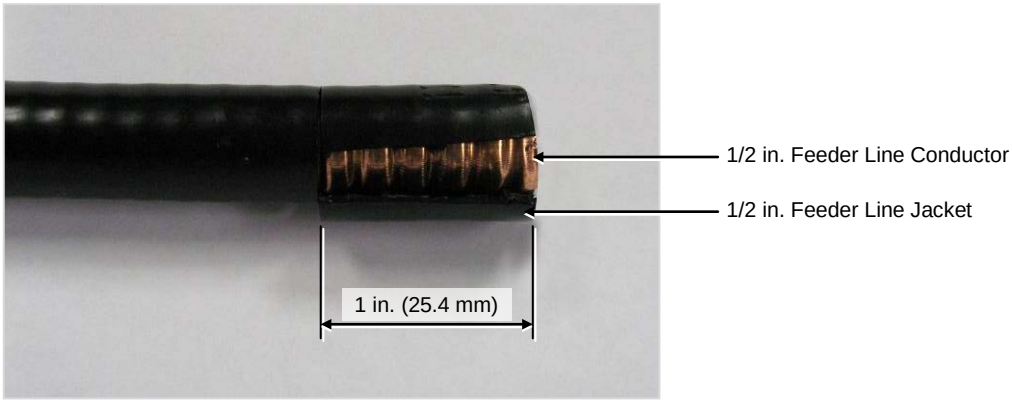
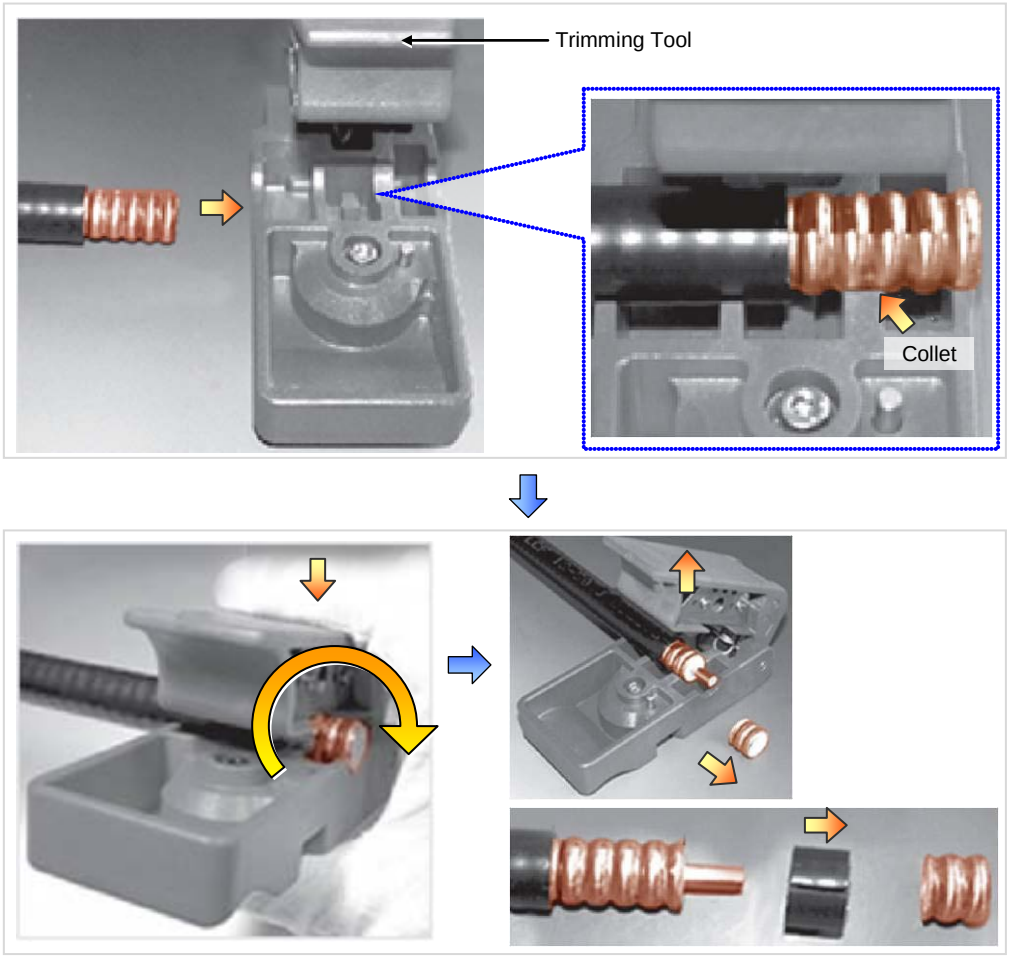


Figure C.8 Assembling the N type-male Connector (1/2 in. Feeder Line) (1)

3) Remove the end 0.43 in. (11 mm) of the external conductor using a trimming tool.



4) Insert the internal conductor into the deburring hole at the bottom of the trimming tool to trim it.

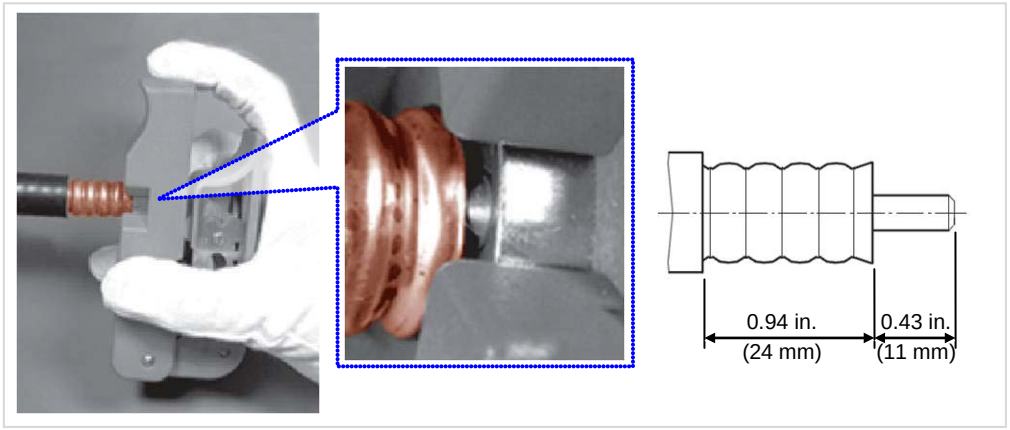


Figure C.9 Assembling the N type-male Connector (1/2 in. Feeder Line) (2)

5) Insert the o-ring, clamping nut, insert ring and N type-male body to the stripped 1/2 in. feeder line in this order.

6) Tighten the clamping nut and N type-male body inserted into the 1/2 in. feeder line firmly using a spanner. The recommended torque for tightening the clamping nut and N type-male body is 306~510 lbf·ft (30~50 N.m). (Note that it should only be fastened by rotating the clamping nut with the external body in a fixed and stable position.)

Figure C.10 Assembling the N type-male Connector (1/2 in. Feeder Line) (3)

7) Insert the heat shrink tube into the 1/2 in. feeder line fitted with the N type-male connector as shown in the figure below.
- Heat shrink tube: Φ 1.1 in., 3.94 in. (Φ 28 mm, 100 mm)

8) Shrink the heat shrink tube inserted into the 1/2 in. feeder line using a heating gun.

Figure C.11 Assembling the N type-male Connector (1/2 in. Feeder Line) (4)

CHECK

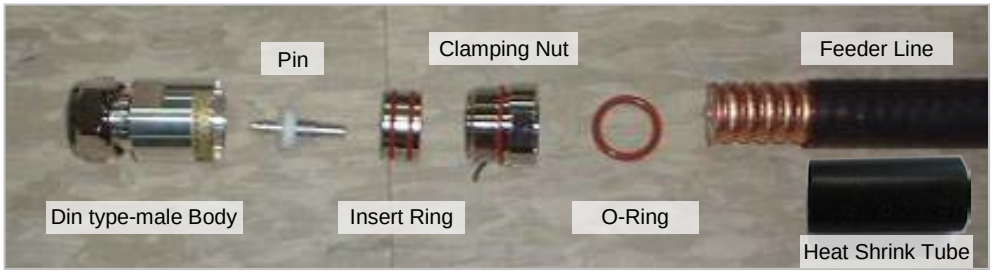
Checking to carry out when assembling the N type-male connector

The shape, tool and assembly method may differ depending on the connector type and manufacturer. Make sure to check the user manual provided by the manufacturer before assembling.

C.6 Din type-male (1/2 in. Feeder Line)

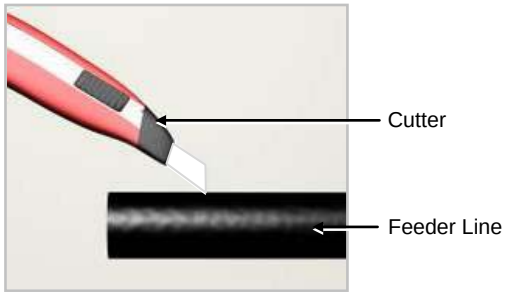
Below is the method for assembling the Din type-male connector to the 1/2 in. feeder line.

1) The components of the Din type-male are an Din type-male body, a pin , an insert ring, a clamp nut, o-ring and a heat shrink tube, and it is assembled using the wire stripper, trimming tool, wrench, etc.



2) Straighten the cable, then, using a suitable tool, strip it to the connector's wire strip length.
When cutting the sheath, hold the cable firmly with one hand and cut the cable pulling the cutting tool inwards with the other hand. Gently rotate the tool several times (do not pull it too hard), so that the internal copper line is not damaged.

3) Using a cutter, cut the sheath from the stripped edge to the end of the cable and completely strip the sheath.



4) Insert the O-ring, clamping nut, insert ring, pin and Din type-male body into the stripped feeder line in this order.

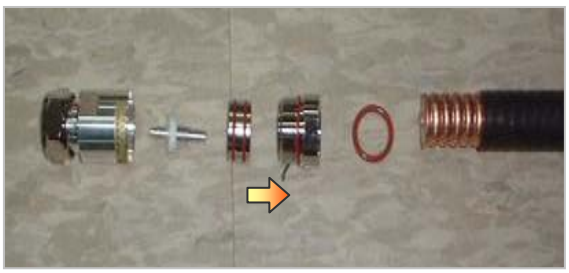
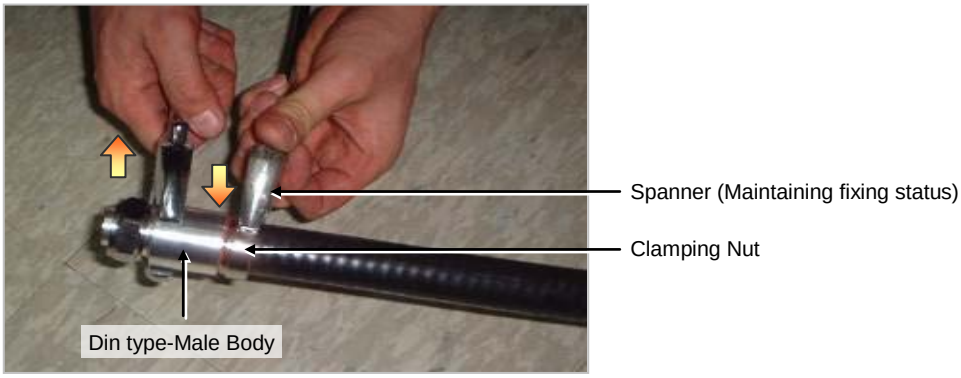


Figure C.12 Assembling the Din type-male Connector (1/2 in. Feeder Line) (1)

5) Tighten firmly the clamping nut and Din type-male body inserted to the 1/2 in. feeder line using a wrench. The recommended torque for tightening the clamping nut and Din type-male body is 306~510 lbf·ft (30~50 N.m). (Note that it should only be fastened by rotating the clamping nut with the external body in a fixed and stable position.)



6) Insert the heat shrink tube (28 mm/10 cm) to the 1/2 in. feeder line fitted with the Din type-male connector; and shrink the heat shrink tube inserted into the feeder line using a heating gun.
- Heat shrink tube: Φ 1.1 in., 3.94 in. (Φ 28 mm, 100 mm)

Figure C.13 Assembling the Din type-male Connector (1/2 in. Feeder Line) (2)

CHECK

Checking to carry out when assembling the Din type-male connector

The shape, tool and assembly method may differ depending on the connector type and manufacturer. Make sure to check the user manual provided by the manufacturer before assembling.

C.7 Finishing connector connection with the tape

Finishing the connection between connectors with the tape (Insulation tape, rubber tape) at outdoor environment is as follows:

1) Overlap (of the half-width of rubber tape) the exposed areas of the connection between connectors with rubber tap, press lightly to give a good adhesion.
2) Wrap the insulation tape more than two times on top of rubber tape overlapping. When you cut the tape, cleanly cut using scissors or knives
3) Tie the end of insulating tape using the cable tie to prevent slips at the end of the insulating tape.

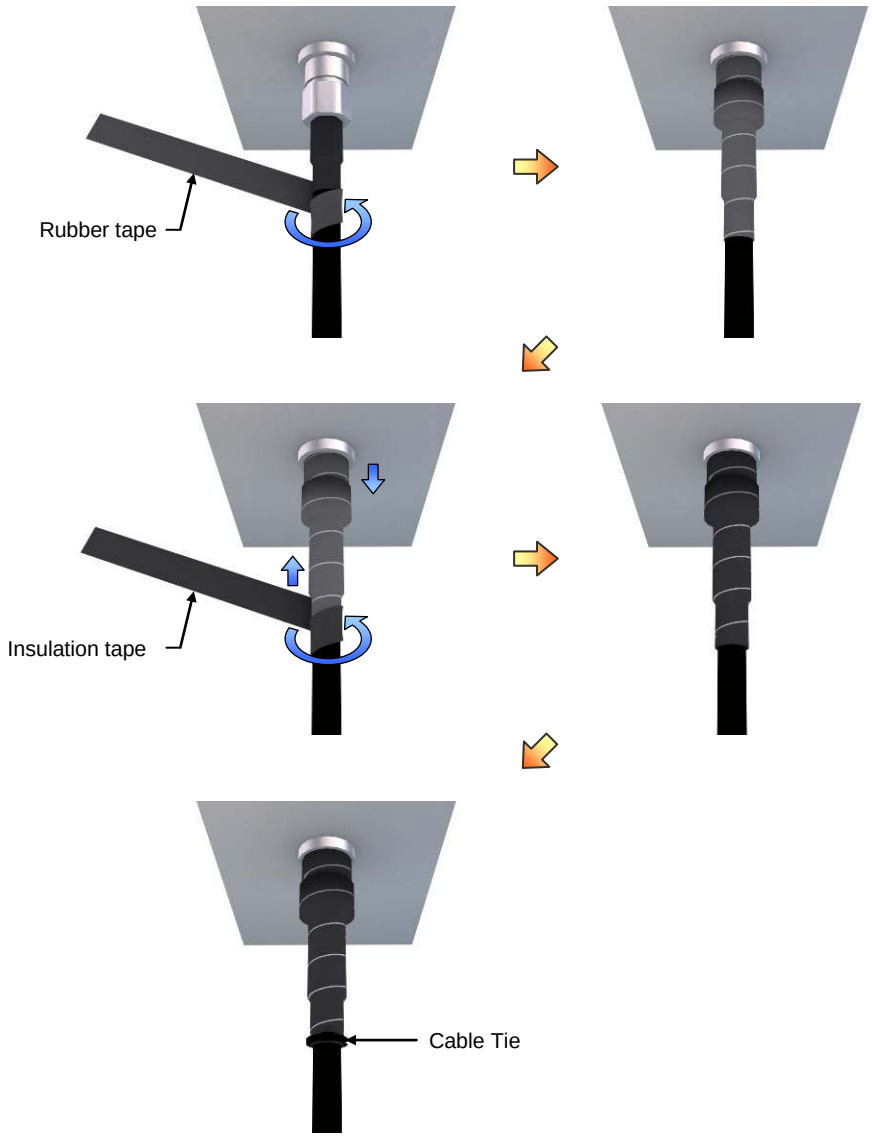


Figure C.14 Finishing connector connection with the tape

C.8 How to Shrink the Heat Shrink Tube

C.8.1 When assembling a connector to the feeder line

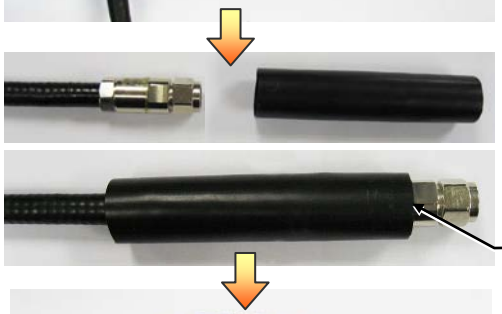
Below is the procedure for shrinking the heat shrink tube.

1) Prepare a 1/2 in. feeder line, heat shrink tube, and heating gun to finish the cable using a heat shrink tube.

1/2 in. Connector

Heat Shrink Tube (Jelly Type)
28/6 × 5.9 in. (150 mm)

Heating Gun



2) Insert the heat shrink tube into the 1/2 in. feeder line, and then place the heat shrink tube at the end of the cutting area of the connector where the tool will be used.

Cutting Area

3) Set the heating gun to 482~572°F (250~300°C).

Figure C.15 Shrinking the Heat Shrink Tube-Feeder line (1)

4) Holding one end of the heat shrink tube with your hand, apply heat starting from the connector using the heating gun.

5) Rotate the heating gun so that heat is evenly distributed to prevent that bubbles are generated or heat is concentrated to a specific part.

6) Shrink the heat shrink tube until jelly appears at the end part of it (refer the figure below) and finish it.

Figure C.16 Shrinking the Heat Shrink Tube-Feeder line (2)

C.8.2 When connecting a connector to another connector

Below is the procedure for shrinking the heat shrink tube.

1) Prepare a 1/2 in. feeder line, 7/8 in. feeder line, heat shrink tube, and heating gun to finish the cable using a heat shrink tube.

Heat Shrink Tube (Jelly Type)
38/12 × 11.81 in. (300 mm)

7/8 in. Feeder Line

2) Inset the heat shrink tube to one end of the feeder line and connect the connector.

Heating Gun

3) Insert the heat shrink tube, placing connector part (where 1/2 in. and 7/8 in. feeder line will be connected) in the center, and mark the center part.

Figure C.17 Shrinking the Heat Shrink Tube-Connector (1)

4) Set the heating gun to 482~572°F (250~300°C).

5) Holding one end of the heat shrink tube with your hand, apply heat starting from the marked part at the center using the heating gun.

6) Rotate the heating gun so that heat is evenly distributed to prevent that bubbles are generated or heat is concentrated to a specific part.

Figure C.18 Shrinking the Heat Shrink Tube-Connector (2)

7) Shrink the heat shrink tube until jelly appears at the end part of it (refer the figure below) and finish it.

Figure C.19 Shrinking the Heat Shrink Tube-Connector (3)

CHECK

Check for Working with the Heat Shrink Tube

- If you work without holding one end of the heat shrink tube, the location of the heat shrink tube may be changed. Therefore, make sure to hold one end of it when applying heat.

- The connector part where 1/2 in. and 7/8 in. feeder line are connected must be the center of the heat shrink tube. After inserting the heat shrink tube, mark the center part.

- If jelly does not appear on the end of the heat shrink tube, it may mean that it is not shrunk properly. Apply heat until jelly appears using a heating gun.

ANNEX D. Cleaning Optic Connector

D.1 Cleaning Optic Connector

When connecting optical cable to the system, performance of system can be decreased or fails can occur if core section of optical connector is dirty due to dust or foreign material. Therefore, worker should clean the optic connector before connecting optic cable to the system to prevent this phenomenon.
This manual describes the method that cleans optic connector when using the IBC™ Brand cleaner.

Caution When Connecting Optical Cables

Before connecting an optical cable, make sure that there is no dust or foreign substance on the cross-section of the connector core. If there is any dust or foreign substance, do not remove it by blowing with your mouth. Remove the dust or foreign substance by referring to the method of cleaning optic connector.

CHECK

When using Optic Connector Cleaner

When using optic connector cleaner, use the products shown in the example below or their equivalents.

Ex) Manufacturer-USCONEC (http://www.usconec.com)

- IBC™ Brand Cleaner (P/N: 9393): For LC-LC and MU Connector Cleaning
- IBC™ Brand Cleaner (P/N: 9392): For SC Connector Cleaning
- IBC™ Brand Cleaner (P/N: 12910): For ODC Connector Cleaning

Manufacturer-TheFibers (www.thefibers.com)

- HuxCleaner 1.25 mm Type: For LC and MU Cleaning
- HuxCleaner 2.5 mm Type: For SC, FC and ST Cleaning

D.2 IBC™ Brand Cleaner

Method that uses IBC™ Brand Cleaner is as follows:

D.2.1 IBC™ brand type cleaner (P/N 9393)

Method that uses IBC™ Brand Cleaner (P/N 9393) for LC-LC and MU connector is as follows:

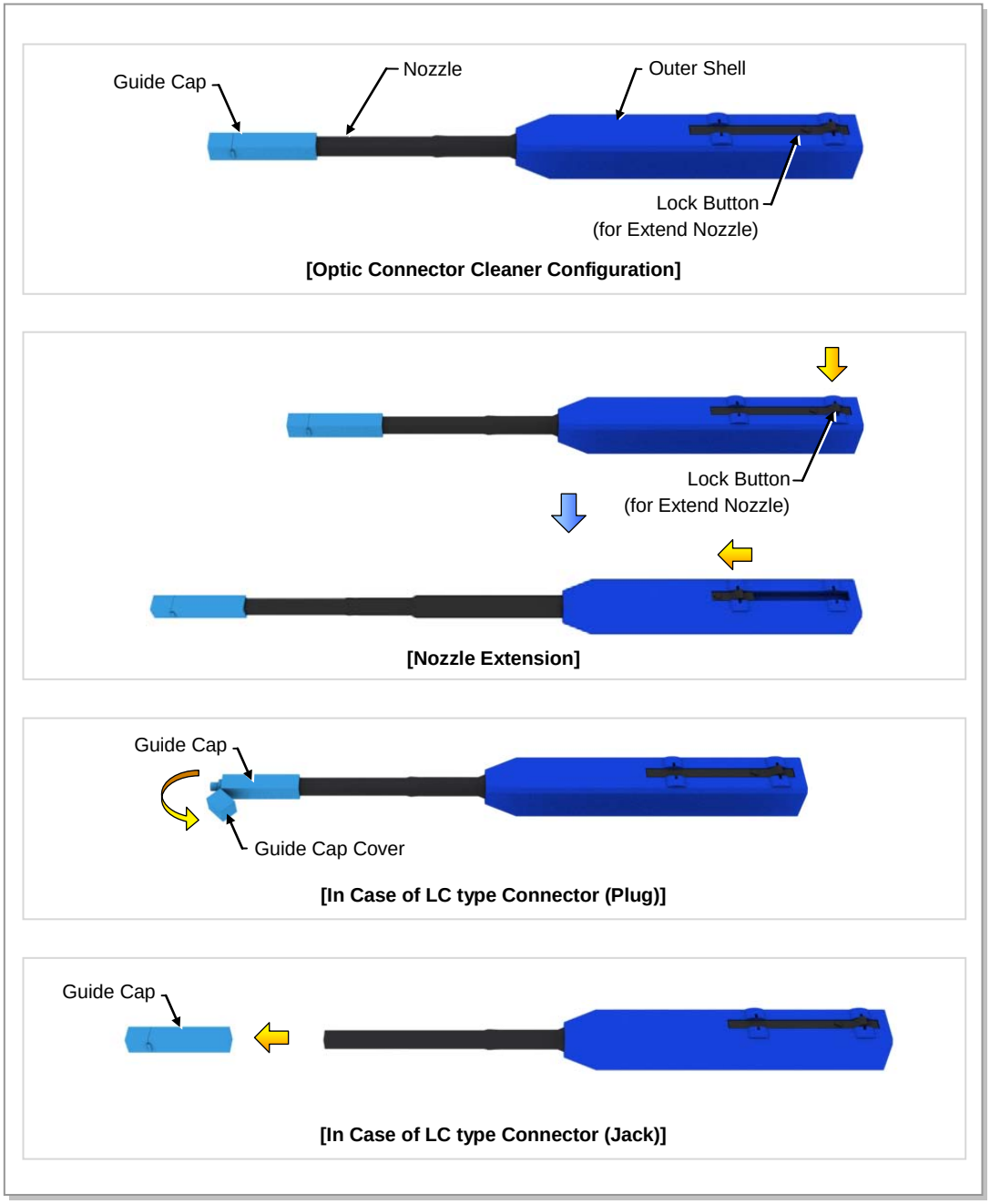
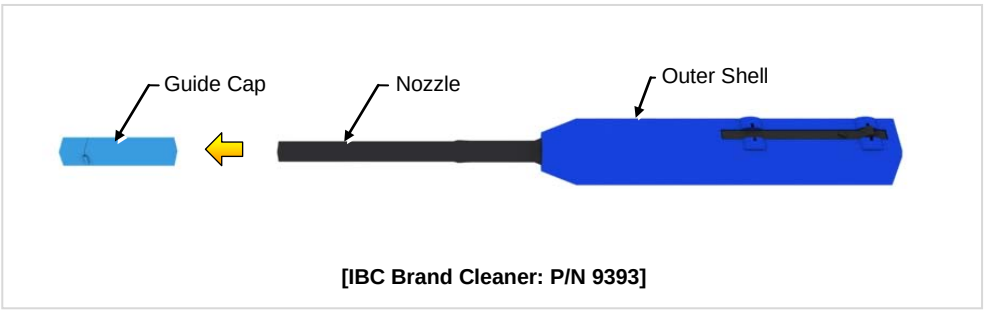


Figure D.1 Optic Connector Cleaner (IBC™ Brand Type Cleaner: P/N 9393)

Optic Module Cleaning (LC type Jack)

1) To clean the optic module, remove the guide cap from the cleaner (P/N: 9393).



[IBC Brand Cleaner: P/N 9393]

2) Insert a cleaner guide cap to every core of the optic module. Clean it by pushing the outer shell toward the nozzle until you hear the sound of the detergent being sprayed. (Repeat once or twice.)

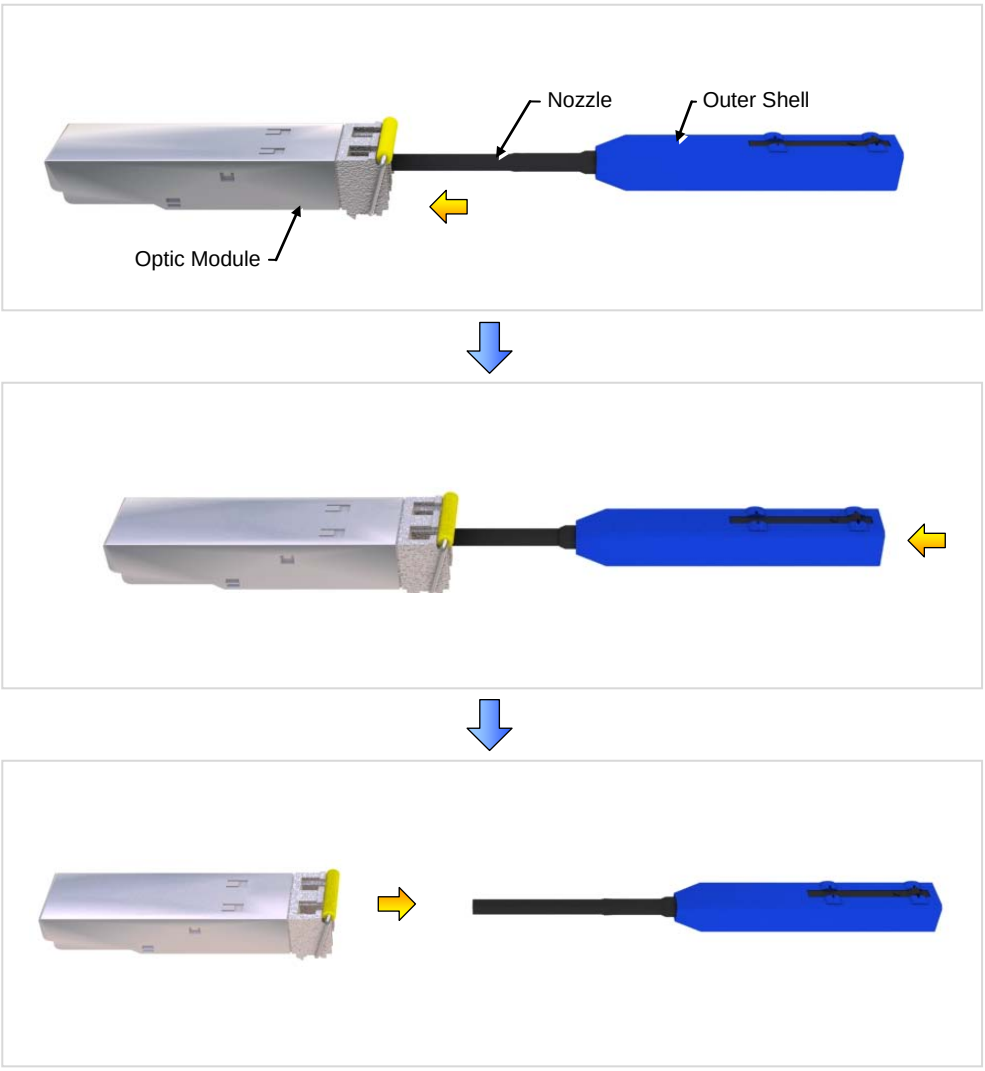
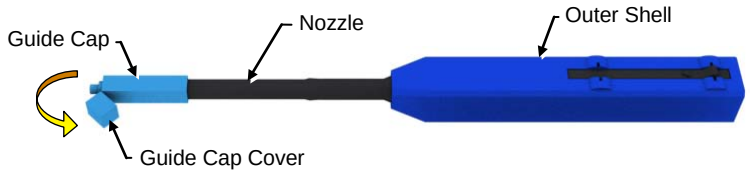


Figure D.2 Optic Module Cleaning (LC type Jack)

Optic Cable Connector Cleaning (LC type plug)

1) To clean the optic cable connector, open the guide cap cover from the cleaner (P/N: 9393).



[IBC Brand Cleaner: P/N 9393]

2) Insert a cleaner guide cap to every core of the optic cable connector. Clean it by pushing the outer shell toward the nozzle until you hear the sound of the detergent being sprayed. (Repeat once or twice.)

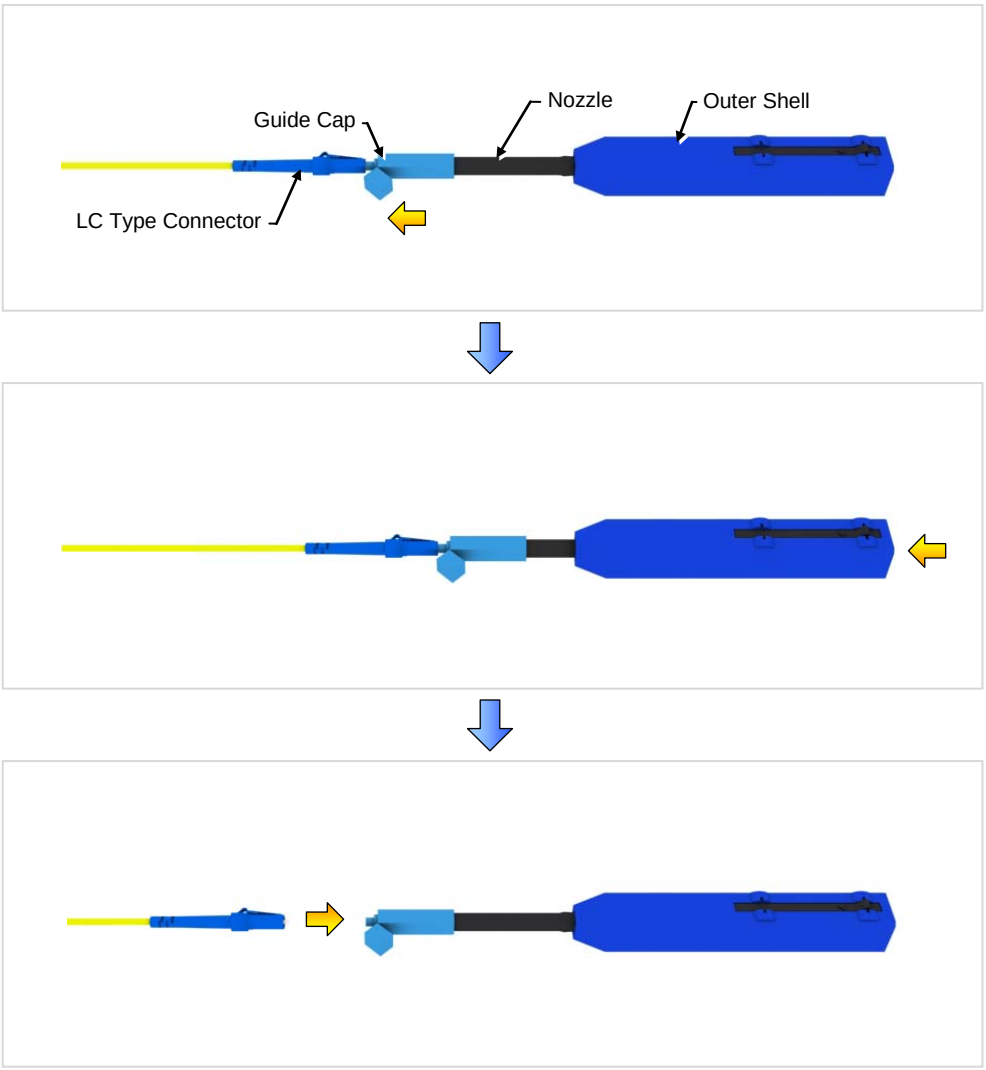
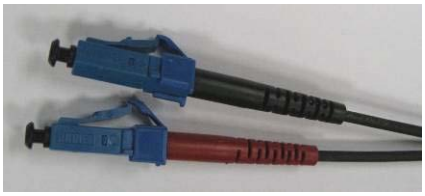


Figure D.3 Optic Cable Connector Cleaning (LC type plug)

Measuring the Optical Output and Connecting the Optic Connector

1) Check the optical output again using an optic power meter.
2) If the optical output measurement result meets the reference value, clean the connector again and connect it. If the measurement result does not meet the reference value, discard the cable, replace it with a new cable, and then clean the new one and connect it to the system.



[LC/PC Plug]

[Optic Powermeter]

Figure D.4 Measuring the Optical Output and Connecting the Optic Connector

ANNEX E. Pressure Terminal Assembly

E.1 Preparations

The followings must be prepared to connect a pressure terminal to a cable.

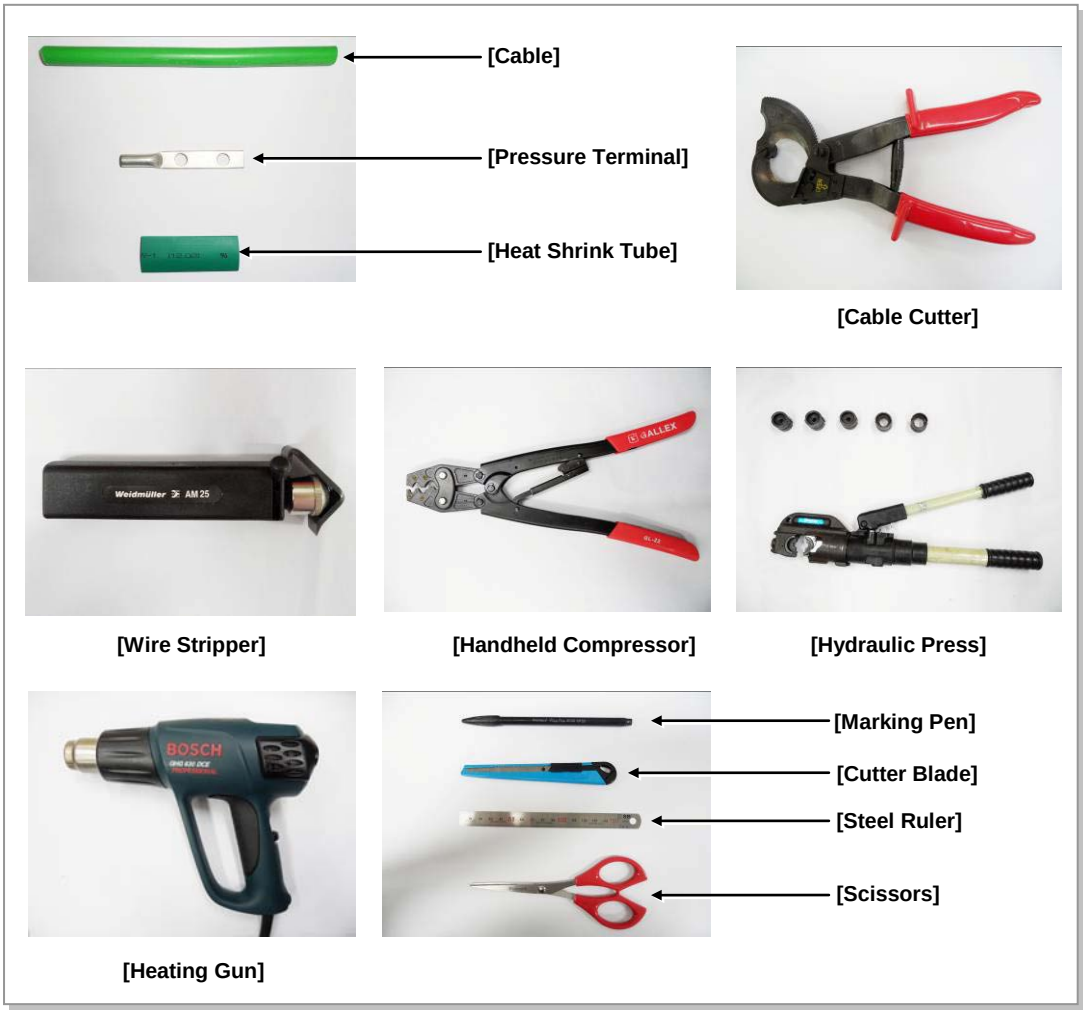


Figure E.1 Preparations

E.2 Pressure Reference Table

The pressure reference table used to assemble a pressure terminal to a cable is shown below.

Table E.1 Pressure Reference Table for Pressure Terminal

Category	Copper tube length of a pressure terminal		Number of pressure points
	In.	mm	
Hand	0.43 in. or less	11 mm or less	1
Hand	0.47~0.59 in.	12~15 mm	2
Hand	0.63~0.91 in.	16~23 mm	3
Hand	0.94~1.26 in.	24~32 mm	4
Hand	1.3 in. or more	33 mm or more	5
Hydraulic	1.18 in. or less	30 mm or less	2
Hydraulic	1.22~1.85 in.	31~47 mm	3
Hydraulic	1.89~2.48 in.	48~63 mm	4
Hydraulic	2.52 in. or more	64 mm or more	5

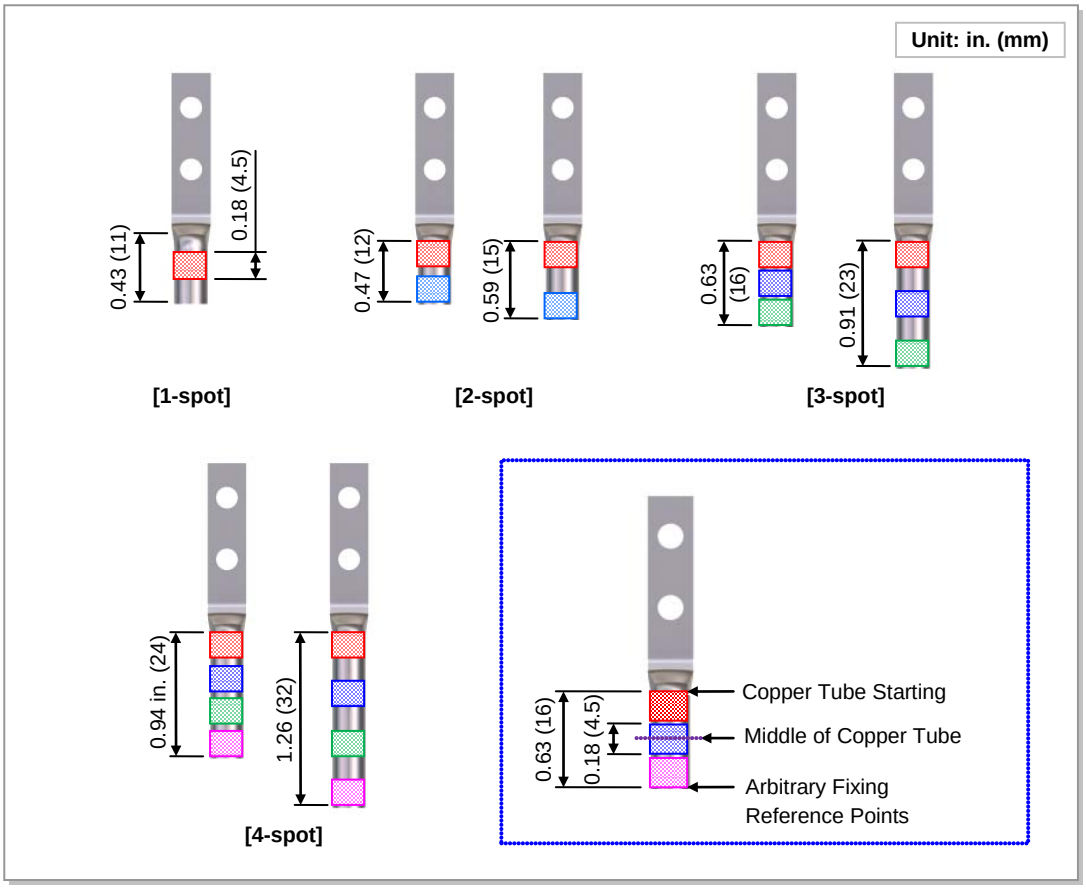


Figure E.2 Pressure Reference Drawing (Handheld Compressor)

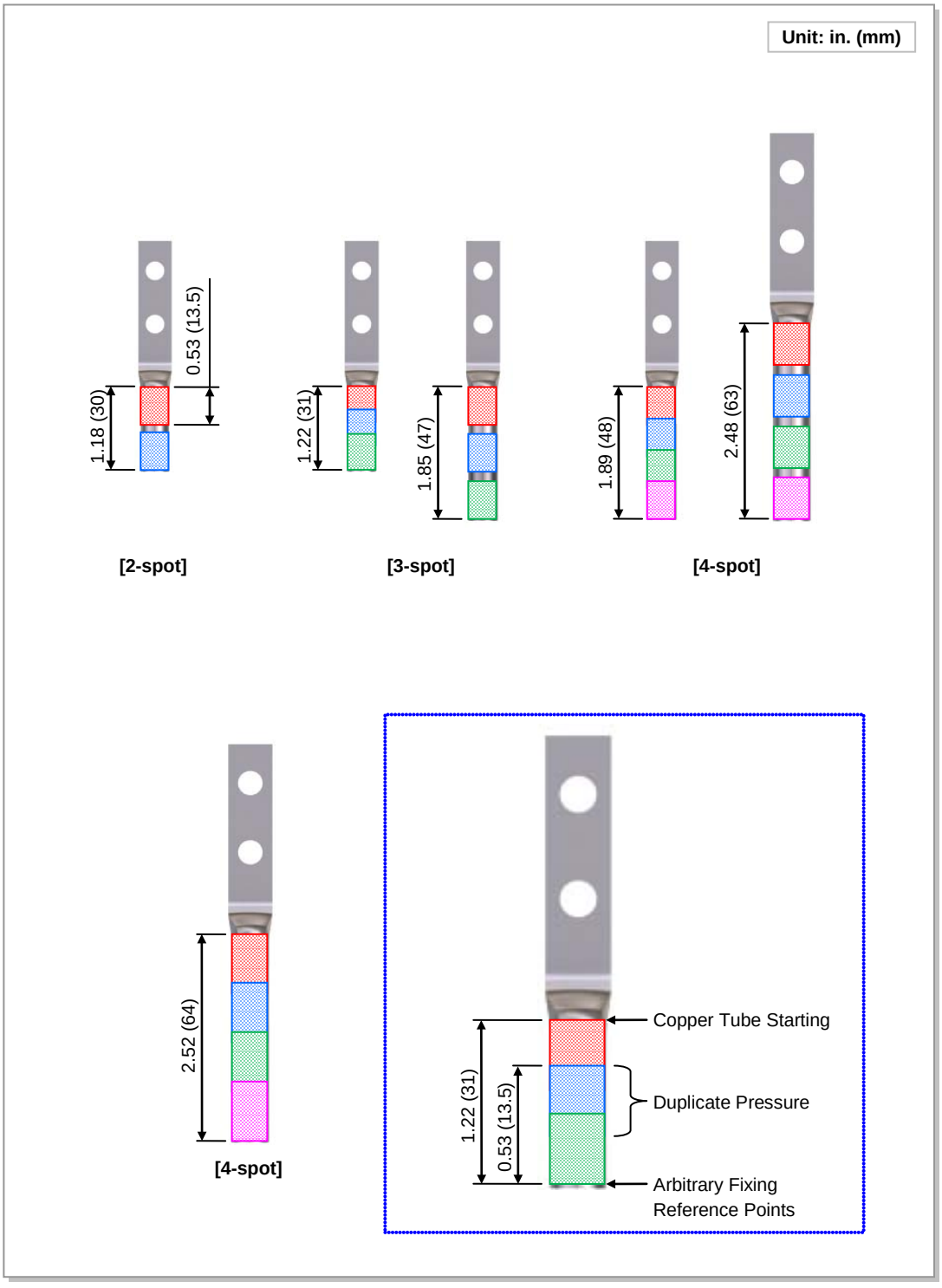


Figure E.3 Pressure Reference Drawing (Hydraulic Press)

Table E.2 Compressor Specifications per Cable Thickness

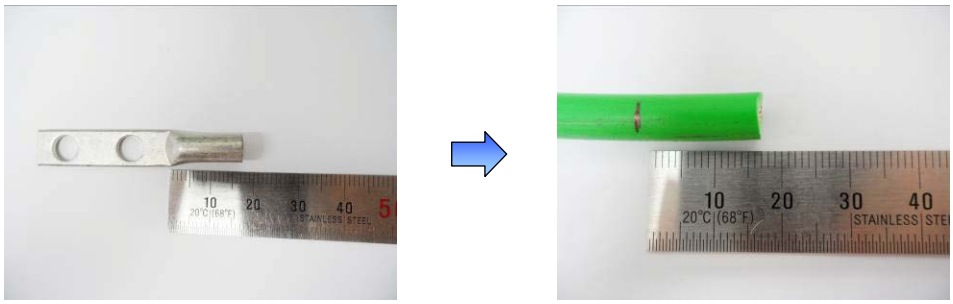
Cable Size		Press Size		
AWG	mm^2	Small Handheld Press	Large Handheld Press (AK-38, 100)	Hydraulic Press (IZUMI Hexagonal Dies)
12	2.5	2	X	X
10	4	2	X	X
8	6	5.5	X	X
6	10	8	8	X
4	16	14	14	16
2	25	22	22	25
1	35	38	38	35
1/0	50	X	60	50
3/0	70	X	80	70
4/0	95	X	100	95~300

E.3 Assembling Pressure Terminal

The procedures for assembling a pressure terminal to a cable are as follows:

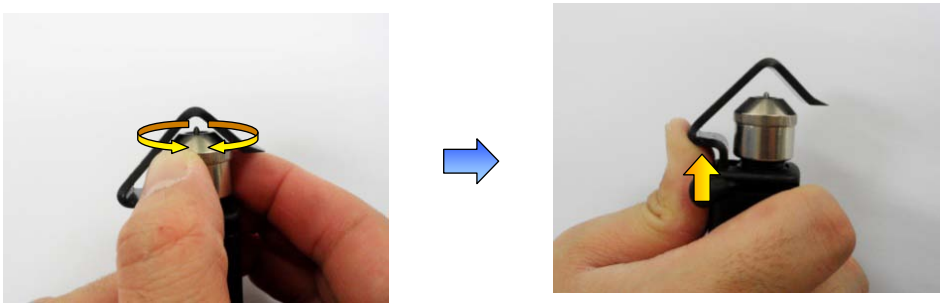
Strip the Cable Sheath

1) After checking the inside length of a pressure terminal, mark the cable.



2) Adjust the length of a cutter blade according to the sheath thickness of the cable.

3) Push the clamp with a thumb a ccording to the cable size to secure a space for the cable.



4) Put a cable into a clamp, locate a blade on a marking position, and push it into the sheath.

5) Align the stripper to be perpendicular to the cable and rotate it more than two laps.

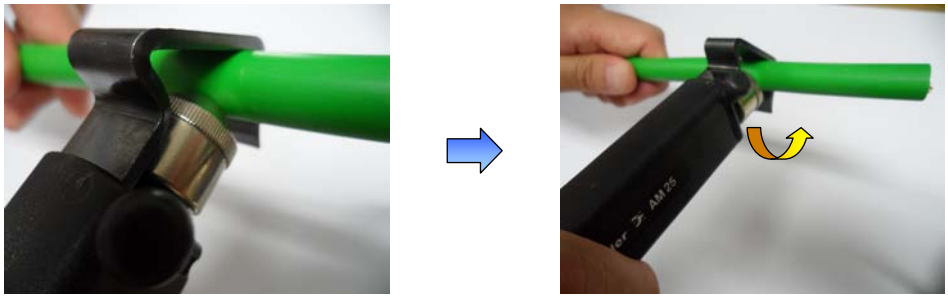
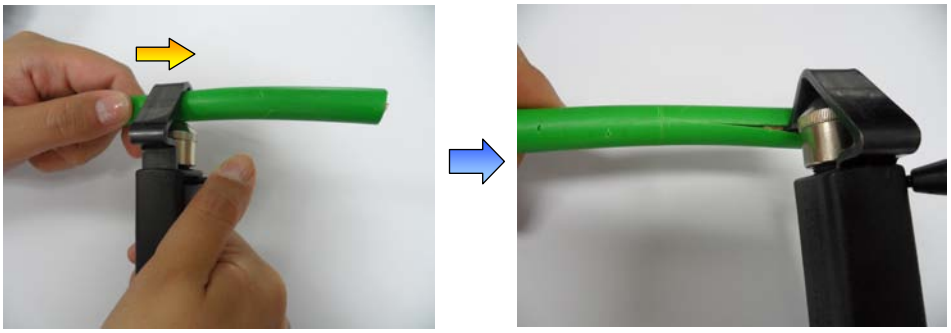


Figure E.4 Stripping Cable Sheath (1)

6) Push the lever of the stripper to the right to turn its blade at 90°.

7) Move the stripper up to the end of cable while maintaining the stripper to be perpendicular to the cable.



8) Remove the sheath.

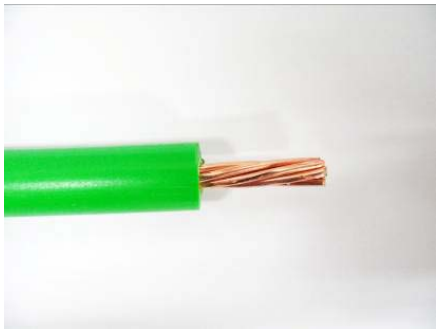


Figure E.5 Stripping Cable Sheath (2)

CHECK

Checking When Using A Wire Stripper

A wire stripper is used differently depending on its manufacturer or type. Therefore, refer to the user manual enclosed with the product.

The specifications and cautions of a wire stripper described in this manual are as follows:

- Vender: Weidmuller
- Model: Weidmuller-AM25
  (Order No-9001080000)
- Specifications: For outer diameter
  0.24-0.94 in. (6-24 mm) PVC clothing Up to 0.18 in. (4.5 mm) clothing cutting depth

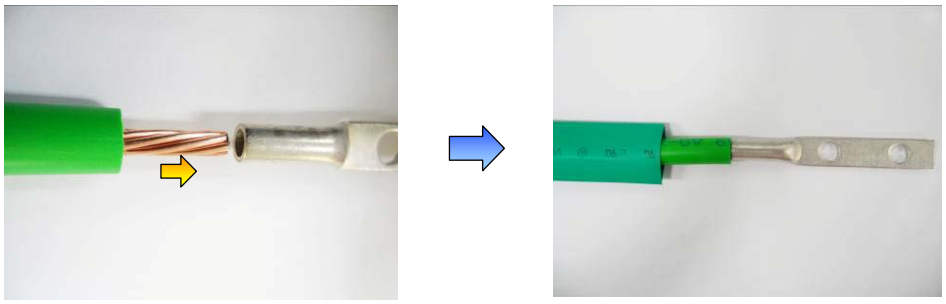
- To prevent the cutter blade of a wire stripper from touching the cable conductor, adjust the length of cutter blade by checking the cable sheath thickness.
- Make sure that the cutter blade goes into the cable sheath completely.
- Rotate the wire stripper perpendicularly to the cable.

[X]

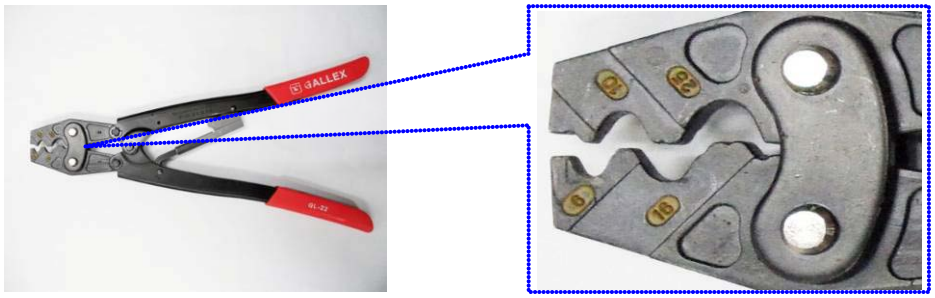
[O]

Fixing Pressure Terminal (Handheld Compressor)

1) Insert the conductor of the cable with the sheath stripped to the internal end of pressure terminal. For a ring type pressure terminal, push it in until the conduct comes out 0.04 in. (1 mm) from the end of the terminal.



2) From the holes of handheld compressor, select one that fits to the pressure terminal.



3) Insert the pressure terminal to the selected hole.

4) Fix the pressure terminal and cable temporarily so the position can be changed later by pressing the compressor.

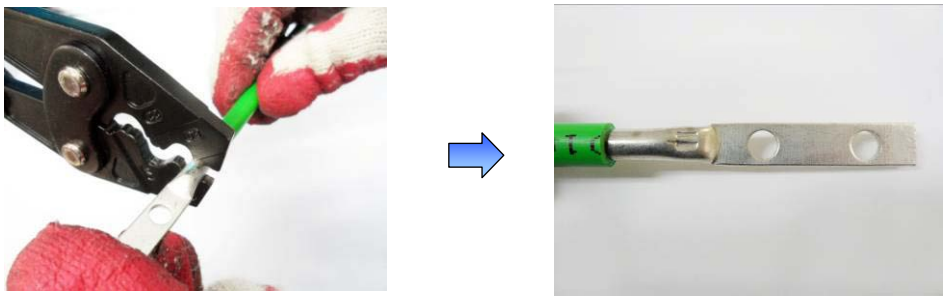
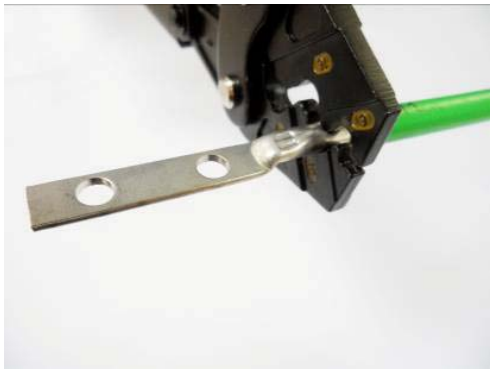


Figure E.6 Fixing Pressure Terminal_Handheld Compressor (1)

5) After complementary of the cable which is temporary fixed, align it to the hole and firmly compress the pressure terminal to secure fix it.



6) Separate the pressure terminal from the handheld compressor. Press down the handle of compressor until a clicking sound is heard to be unlocked.

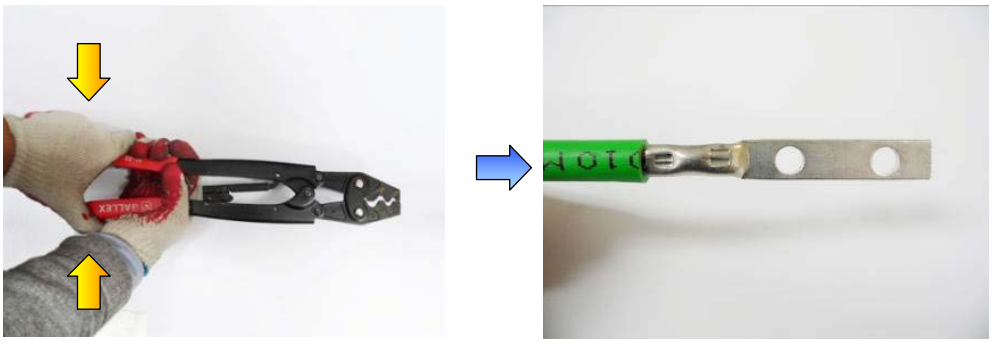


Figure E.7 Fixing Pressure Terminal_Handheld Compressor (2)

CHECK

Checking When Using A Handheld Compressor

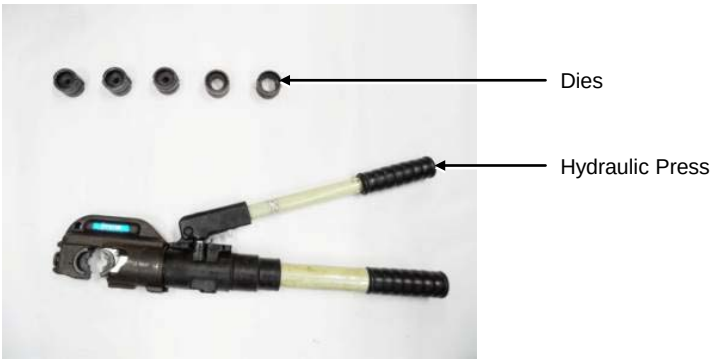
A handheld compressor is used differently depending on its manufacturer or type. Therefore, refer to the user manual enclosed with the product.

The specifications and cautions of a handheld compressor described in this manual are as follows:

- Vender: GALLEX
- Model: GL-2045A-22
- Specification: 5.5 mm^2, 8 mm^2, 14 mm^2, 22 mm^2 (JIS), 6 mm^2, 10 mm^2, 16 mm^2, 25 mm^2 (DIN)

Fixing Pressure Terminal (Hydraulic Press)

1) Among the dies of the hydraulic press, select one that fits to the pressure terminal.



2) Assemble the dies to the pressing area of the compressor.

3) Insert the pressure terminal into the pressing area and fix it slightly by aligning it to the end of cable sheath.

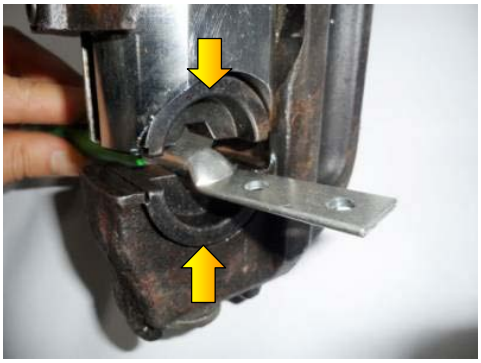
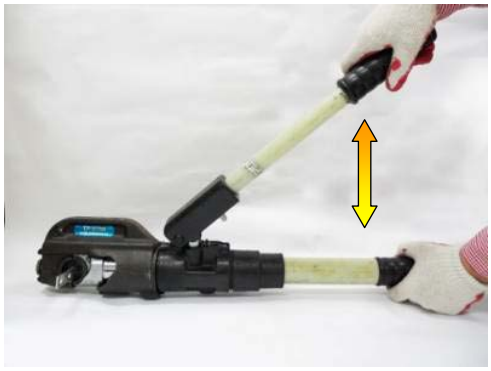


Figure E.8 Fixing Pressure Terminal_Hydraulic Press (1)

4) Move the compressor lever up and down to press the pressure terminal firmly.



5) Turn the top compressing lever clockwise and then push it down. When the pressing area of compressor is loosened, remove the pressure terminal.

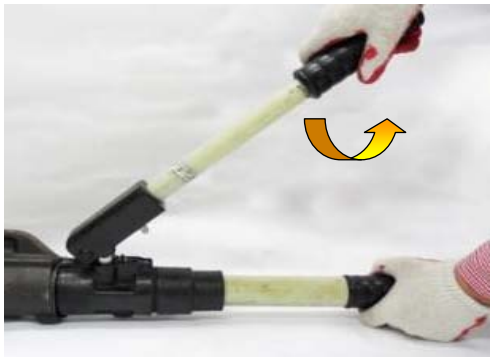


Figure E.9 Fixing Pressure Terminal_Hydraulic Press (2)

CHECK

Checking When Using a Hydraulic Press

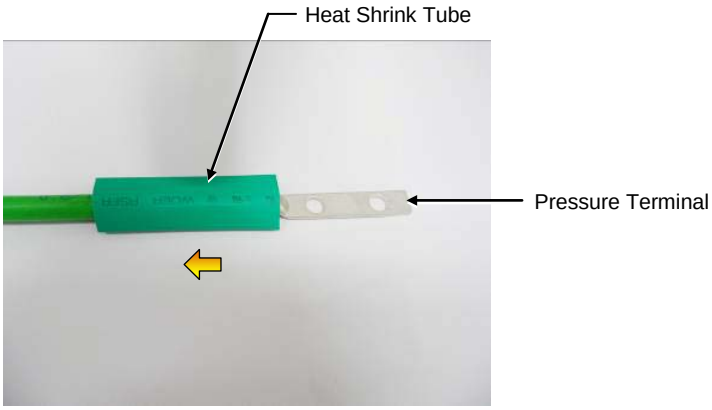
A hydraulic press is used differently depending on its manufacturer or type. Therefore, refer to the user manual enclosed with the product.

The specifications and cautions of a hydraulic press described in this manual are as follows:

- Vender: IZUMI
- Model: IZUMI-EP-510B
- Specification: Circular 32~160 (SQ)
  Hex 14~325 (SQ)

Assembling Heat Shrink Tube

1) After assembling a pressure terminal, move the heat shrink tube, inserted to the cable, to the end of pressure terminal copper tube.



2) Set the temperature of the heat gun to 356~392˚F(180~200˚C).

3) Locate a heat shrink tube to cover the entire copper tube of the pressure terminal.

4) Rotate a heat gun 360° to apply heat evenly to shrink the tube.
(Because the pressure terminal and the cable is hot due to the heat of a heating gun, be careful not to have a burn.)

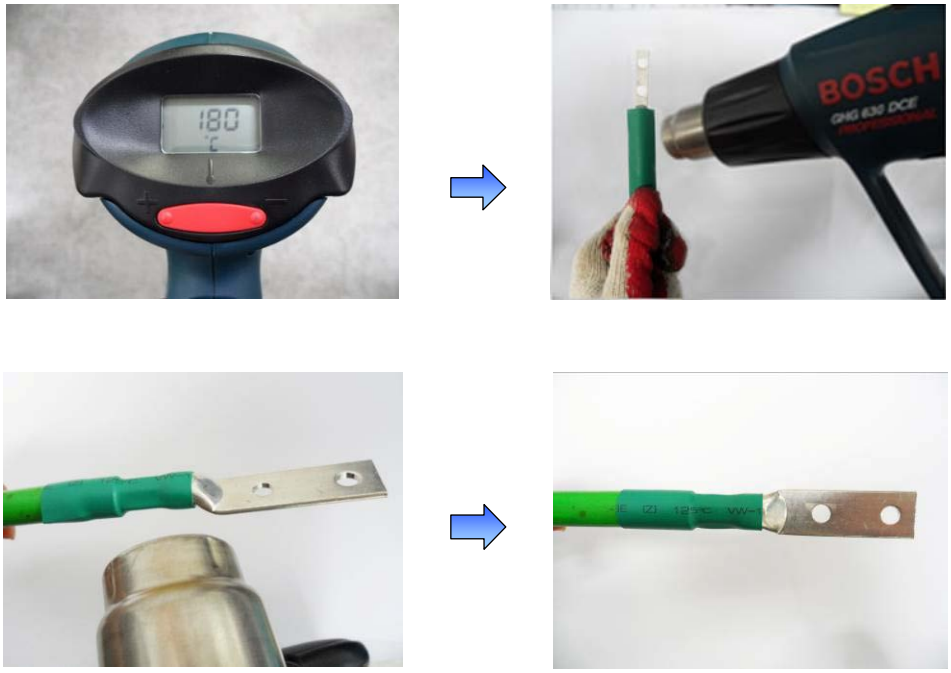


Figure E.10 Assembling Heat Shrink Tube

ANNEX F. Standard Torque

When you fasten the bolt, refer to the standard torque value below to prevent the equipment and bolt from damage and fasten tightly. When the torque value for each connection part is defined already, refer to the defined value.

Table F.1 Standard Torque Value for Tightening Bolts

Bolt Spec.	Torque (kgf.cm)	Torque (N.m)	Torque (lbf.ft)
M3	4.08~6.12	0.40~0.60	0.29~0.44
M4	9.52~14.28	0.93~1.40	0.69~1.03
M5	20.0~30.0	1.96~2.94	1.45~2.17
M6	33.28~49.92	3.26~4.90	2.41~3.61
M8	82.4~123.6	8.08~12.12	5.96~8.94
M10	166.4~249.6	16.32~24.48	12.03~18.05
M12	292.0~438.0	28.64~42.65	21.11~31.67

Table F.2 Brass Bolts Torque

Bolt Spec.	Torque (kgf.cm)	Torque (N.m)	Torque (lbf.ft)
M6	29.98 ± 10 %	2.94 ± 10 %	2.17 ± 10 %
M8	64.26 ± 10 %	6.3 ±1 0 %	4.16 ± 10 %

Check When Applying standard torque value

The torque value can change depending on the equipment and materials, properties and specifications of the fastening bolts. Therefore, you must check the appropriate torque value of each equipment and fastening bolts according to its spec.

This page is intentionally left blank.

ABBREVIATION

C

CDMA	Code Division Multiple Access
CPRI	Common Public Radio Interface

D

DC	Direct Current

E

EMC	Electromagnetic Compatibility

G

GPS	Global Positioning Satellite

I

I/O	In/Out

L

LTE	Long Term Evolution

M

MGB	Main Ground Bar

R

RET	Remote Electrical Tilting
RF	Radio Frequency
RRH-P4	Remote Radio Head-PCS band 4Tx/4Rx

T

TGB	Tower Ground Bar

U

UADU	Universal Platform Digital Unit

	Warning: Exposure to Radio Frequency Radiation The radiated output power of this device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should not be less than 500cm during normal operation. The gain of the antenna is 18 dBi. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Smart MBS RRH-P4

Installation Manual

SAMSUNG ELECTRONICS