SAMSUNG

5G NR HRU
Installation Manual

Describes product installation and requirement procedure.

Document Version 1.0
August 2018

Radio Access Network

Document Number: 2600-00MST9GAA

SNMTC-v3-0312

This manual should be read and used as a guideline for properly installing and/or operating the product. Owing to product variations across the range, any illustrations and photographs used in this manual may not be a wholly accurate depiction of the actual products you are using.
This manual may be changed for system improvement, standardization and other technical reasons without prior notice.

Samsung Networks documentation is available at **http://www.samsungdocs.com**

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Preface

This manual describes how to install a Samsung 5G NR Hybrid Radio Unit (HRU), SFG-AB203, and how to connect its cables.

Conventions in this Document

Samsung Networks product documentation uses the following conventions.

Symbols

Symbol	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

- The input and output text is presented in the Courier New font. For example, `context <designated epc-context-name>`
- The CLI command is presented in capital letters and Courier New, bold style. For example, Type the **`RTRV-NE-STS`** command in the input field.
- The YANG object is presented in the small letters and boldface. For example, **eutran-cell-conf-idle**

Revision History

The table below outline all the versions of this document:

Document Version	Publication Date	Remarks
1.0	August 2018	First version

Organization of This Document

Section	Title	Description
Chapter 1	Before Installation	This chapter introduces HRU and describes the items that should be understood before installation.
Chapter 2	Installing System	This chapter describes the procedures to install the HRU.
Chapter 3	Connecting Cables	This chapter describes the procedures to connect the cables to the installed HRU.
Chapter 4	Inspect the Installation	This chapter describes the procedures of inspecting installation status after the HRU installation and cabling is completed.
Appendix A	Acronyms	This appendix describes the acronyms used in this manual.
Appendix B	Clean the Optical Connectors	This appendix describes the procedure of cleaning the optical connector and cleaning tool.
Appendix C	Standard Torque	This appendix describes the standard torque when fastening the bolt.

Related Documentation

- 5G NR System Description

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

Electrical

The product is designed to operate from a -48 V DC and 230 V AC.

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by UL 60950. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under EN 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors-cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed in order to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm^2.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

The product is powered from a -48 V DC and 230 V AC supply. To protect against fire, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with UL 60950, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly.

Power Supply Connection

Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of UL 60950 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

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**.’

FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Equipment Markings

This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, and USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

Protective earth

HRU should be grounded.

Chapter 1 Before Installation

This chapter introduces the HRU system and describes the items that you should know before installation.

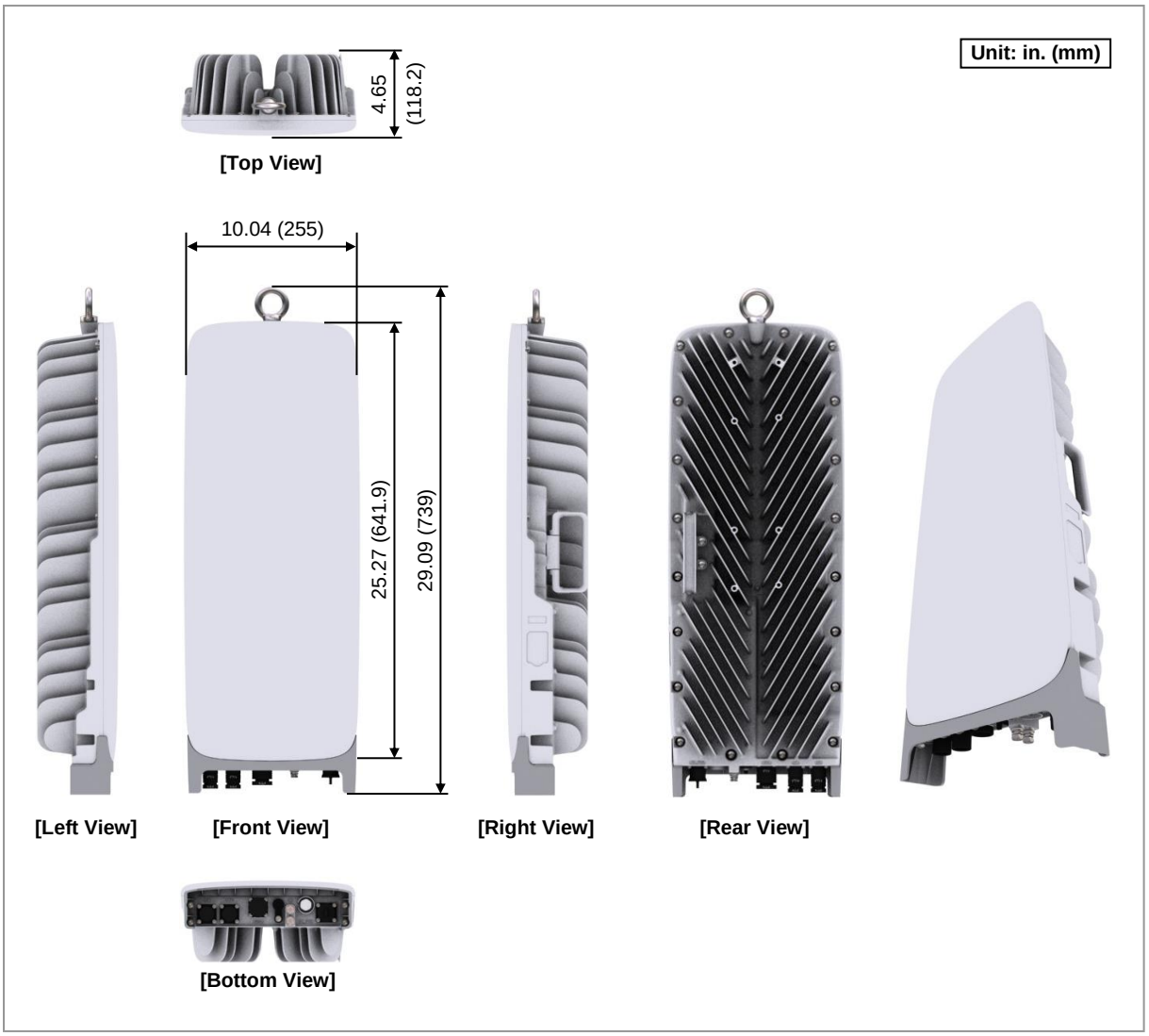
HRU View and External Interface

This section provides the physical structure of the HRU and its interfaces.

HRU View

The figure below depicts the physical structure of the HRU:

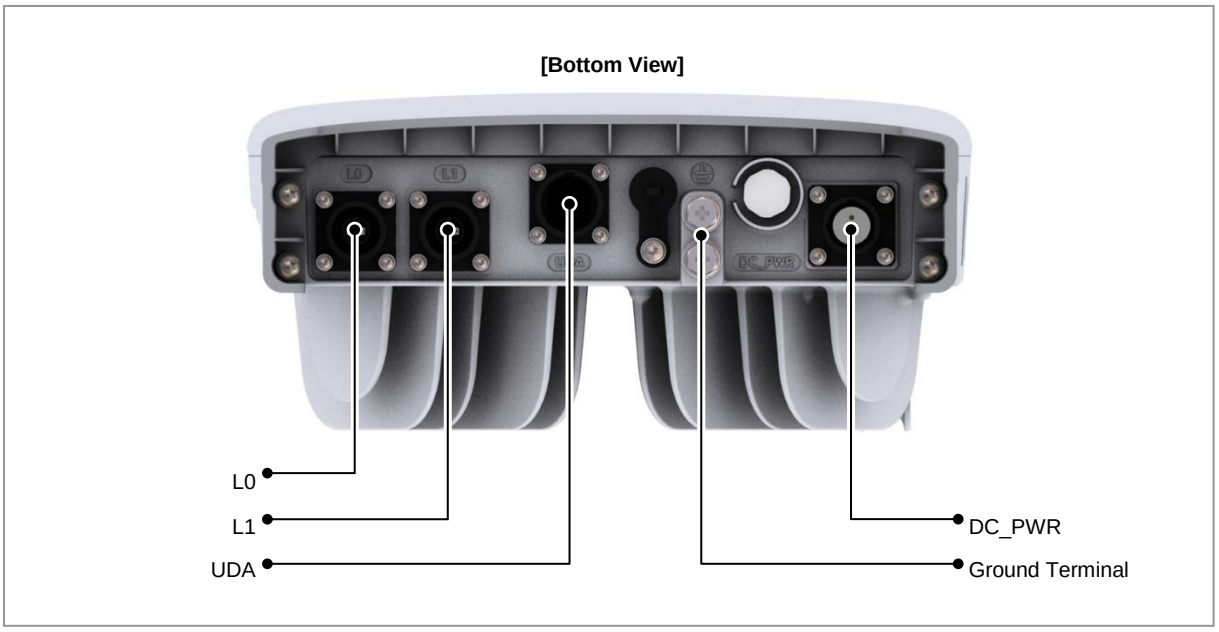
Figure 1. HRU View



HRU External Interface

The figure below depicts the external interface structure of the HRU:

Figure 2. HRU External Interface



Specifications

The table below outlines the main specifications of the HRU:

Table 1. Specifications

Item	SFG-AB203
Technology	5G NR
Operating Frequency	27.5 to 28.35 GHz
Channel Bandwidth	100 MHz
Operating Bandwidth	100 MHz × 8 Carrier
Antenna Configuration	Integrated Antenna • Data Channel: 4Tx/4Rx • RF chain per Data Channel: 256 (Total 1024 RF Chains/Unit)
RF Output Power	EIRP 54 dBm/Path, 60 dBm/Unit (Antenna Gain: 24 dBi)
Input Voltage	-48 V DC (-36 to -58 V DC)
Input Current	5.4 A @ -48 V DC
LED	Total: 1 EA Powered, Operational, Fail (3 Status w/different colors)
Operational Temperature	-40 to 55°C
Humidity	-5 to 100 % RH, condensing, not to exceed 30 g/m^3 absolute humidity
IP rating	IP65
EMC	FCC Part 15
FCC	FCC Part 30
Installation	Pole/Wall/Tower mounting
Dimension (W × D × H)	25.27 in. (641.9 mm) × 10.04 in. (255.0 mm) × 4.65 in. (118.2 mm)
Volume	< 19.3 L
Weight	< 37.48 lb (17.0 kg)

Cautions for Installation

Observe the safety instructions described in this section when installing the system.

Installation should be done in accordance with the applicable local electric codes.

Before Installing

Before starting the installation, ensure the following:

- Post warning signs in areas where high-voltage cables are installed.
- Post ‘off limit’ signs in areas where accidents are most expected.
- Use guardrails or fences to block open areas such as ditches, open roof areas, and scaffolds.

Install the system in the restricted access area.

While Installing

During installation, ensure the following:

The system power must be cut off before installing.

Ensure that the power switch of the power supply is off when installing the system. Installing the system with power on may cause system damage or fatal human injury when connecting or disconnecting cables.

Ensure that workers wear protection gloves and goggles to prevent injury from debris while drilling holes in a wall or ceiling.

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

Cover unused ports with a cap. This prevents foreign substances from entering into the unused ports.

To prevent foreign substances, outdoor air, and moisture from entering the cable inlet (including cable gland and conduit), finish the inlet as follows:
- Unused inlet: Use the hole finishing materials including cap and rubber packing.
- Cable-installed inlet: After cable installation, block any space in the inlet with tape, compressed sponge, rubber packing, and silicone.

After Installing

After installation, remove any debris produced during the work and clean up the installation site.

In the system, the laser beam light runs through the optical cable. The workers must handle the optical cables with care as the laser beam can seriously damage the eyes.

Ensure that the workers do not damage installed cables while cleaning the system.

While cleaning the power supply device, take precaution that the device does not come in contact with foreign objects that may cause power failure.

Installation Tools

The basic tools required for installation are listed in the table below. The additional tools required for each site need to be identified and arranged during a site survey before starting the installation.

Table 2. Basic Installation Tools

Number	Name	Specification	Purpose of use
1	Torque Driver 	Apply a torque range : 20 to 90 lbf·in	Fastening M6 SEMS
2	Screw Driver Bit	+, No. 3	Fastening M6 SEMS
3	Screw Driver 	+, No. 3	Loosening M6 SEMS
4		T30H	Fastening Torx Screw (T30H)
5	Torque Wrench 	Apply a torque range : 10 to 50 lbf·in	Tightening M6 hexagonal. bolt
		Apply a torque range : 100 to 400 lbf·in	Tightening M8 and M10 hexagonal. bolt
6	Torque Wrench Spanner Head 	Apply hexagonal bolt head: 10 mm (for 10 to 50 lbf·in)	Tightening M6 hexagonal bolt
		Apply hexagonal bolt head: 13 mm (for 100 to 400 lbf·in)	Tightening M8 hexagonal bolt
		Apply hexagonal bolt head: 17 mm (for 100 to 400 lbf·in)	Tightening M10 hexagonal nut
7	Spanner 	10 mm	Loosening M6 hexagonal bolt
		13 mm	Loosening M8 hexagonal. bolt
		17 mm	Tightening M10 hexagonal nut
8	Tape Measure 	16 ft./150 ft.	Measuring length
9	Power Extension Cable 	100 ft.	Basic tool
10	Level 	Normal	Levelling horizontality and verticality

Number	Name	Specification	Purpose of use
11	Hammer Drill 	Normal	Drilling wall
12	Concrete Drill Bit 	14 mm	Setting M10 Anchor
13	Cable Cutter 	0.24-1.26 in. (6-32 mm)	Cutting cable
14	Crimping Tool 	14 AWG-4 AWG (1.5 to 16 mm^2)	Crimping pressure terminal
15	Wire Stripper 	Apply cable thickness: 1.5 to 6.2 in. (4 to 16 mm)	Removing cable sheath
16	Nipper 	Basic Tool	Cutting cable
17	Industrial Scissor 	Basic Tool	Cutting
18	Knife 	Basic Tool	Cutting
19	Multi tester 	Digital Pocket Tester	Checking voltage and current to detect cable disconnection
20	Fiber Optical Test Set 	Wave length: 1310 nm, 1550 nm (single mode) 850 nm, 1310 nm (multi-mode)	Checking optical level
21	Compass 	Normal	Checking azimuth during installation
22	Heating Gun 	50°C to 300°C	Shrinking the feeder cable tube
23	Anchor Punch 	M10	Setting M10 anchor

Number	Name	Specification	Purpose of use
24	Hammer 	Normal	Fixing anchor
25	MPO Cleaning Tool 	FUJIOPTICS (Part No.: CLE-ELE-1.25/2.5)	Cleaning MPO connector

The required installation tools may vary depending on the site conditions.
In addition to the basic tools, protractor, ladder, safety equipment, and cleaning tools must also be arranged, considering the site conditions.

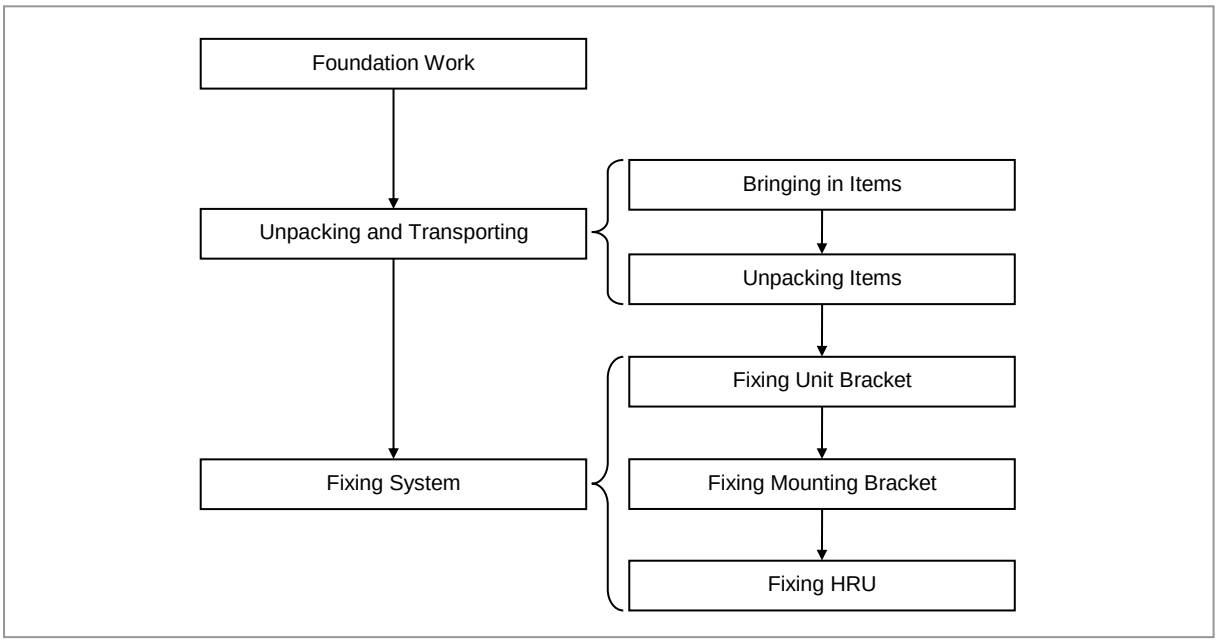
Chapter 2 Installing System

This chapter describes the installation procedures of the HRU.

Installation Procedure

The figure below depicts the overall procedures for installing the HRU:

Figure 3. Procedure to Install the HRU



System Arrangement

A minimum distance must be secured around the HRU, in each direction for installation and maintenance.

The recommended clearance for installing the HRU is as follows.

Category	Recommended Distances	Remarks
Front	≥ 32 in. (800 mm)	-
Sides	≥ 8 in. (200 mm)	Standard Installation
Top	≥ 12 in. (300 mm)	-
Bottom	≥ 12 in. (300 mm)	Over the air, without cover
	≥ 16 in. (400 mm)	Over the ground, without cover

Using Tilting and Swiveling Bracket

The figures below depict the recommended distances for each direction of the HRU using the tilting and swiveling bracket for the wall and the pole type installations:

***Figure 4.** HRU Arrangement_1 Sector Pole Type Installation*

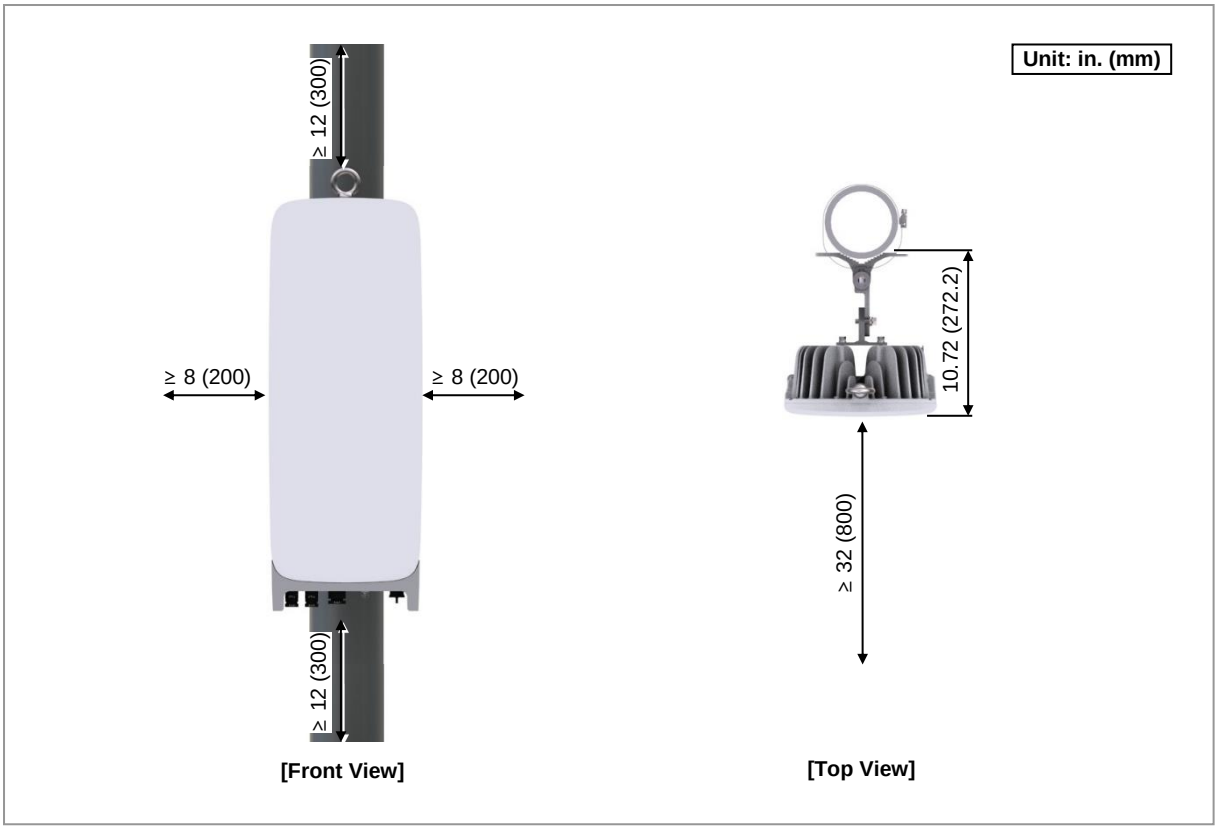


***Figure 5.** HRU Arrangement_2 Sector Pole Type Installation*

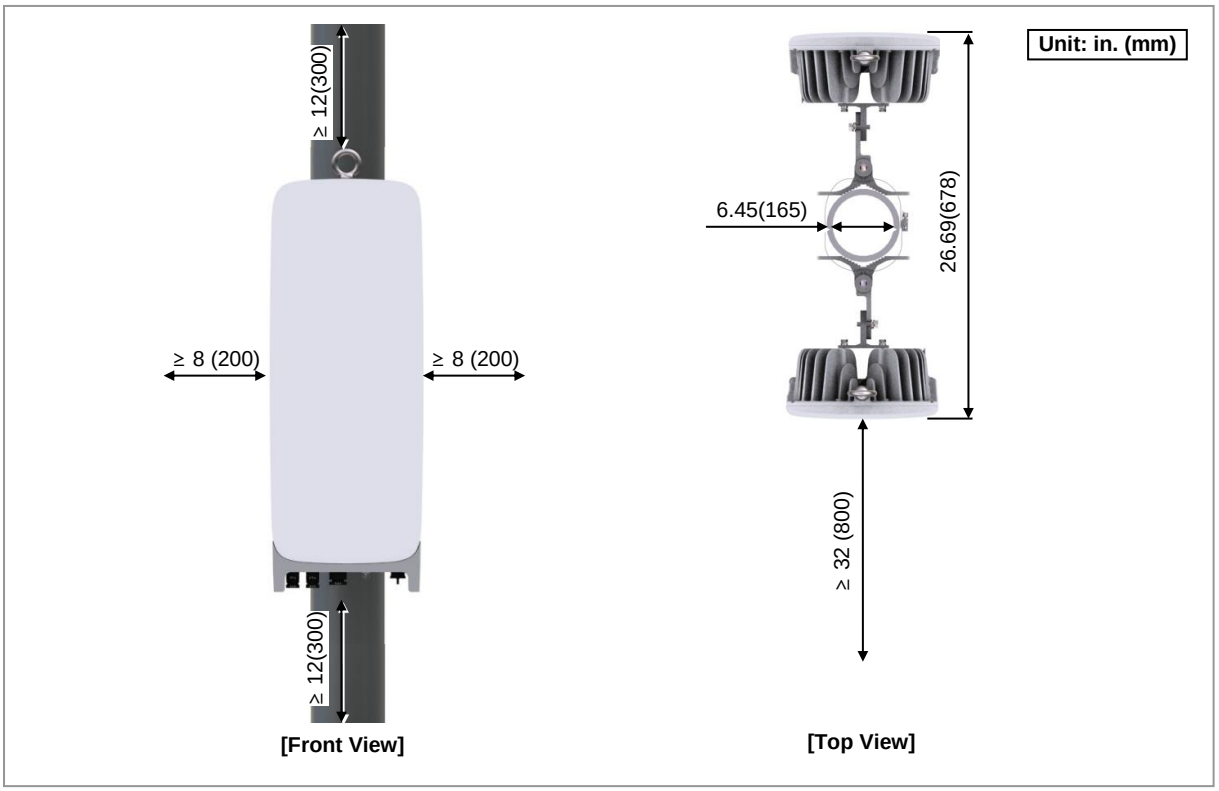


***Figure 6.** HRU Arrangement_1 Sector Wall Type Installation*

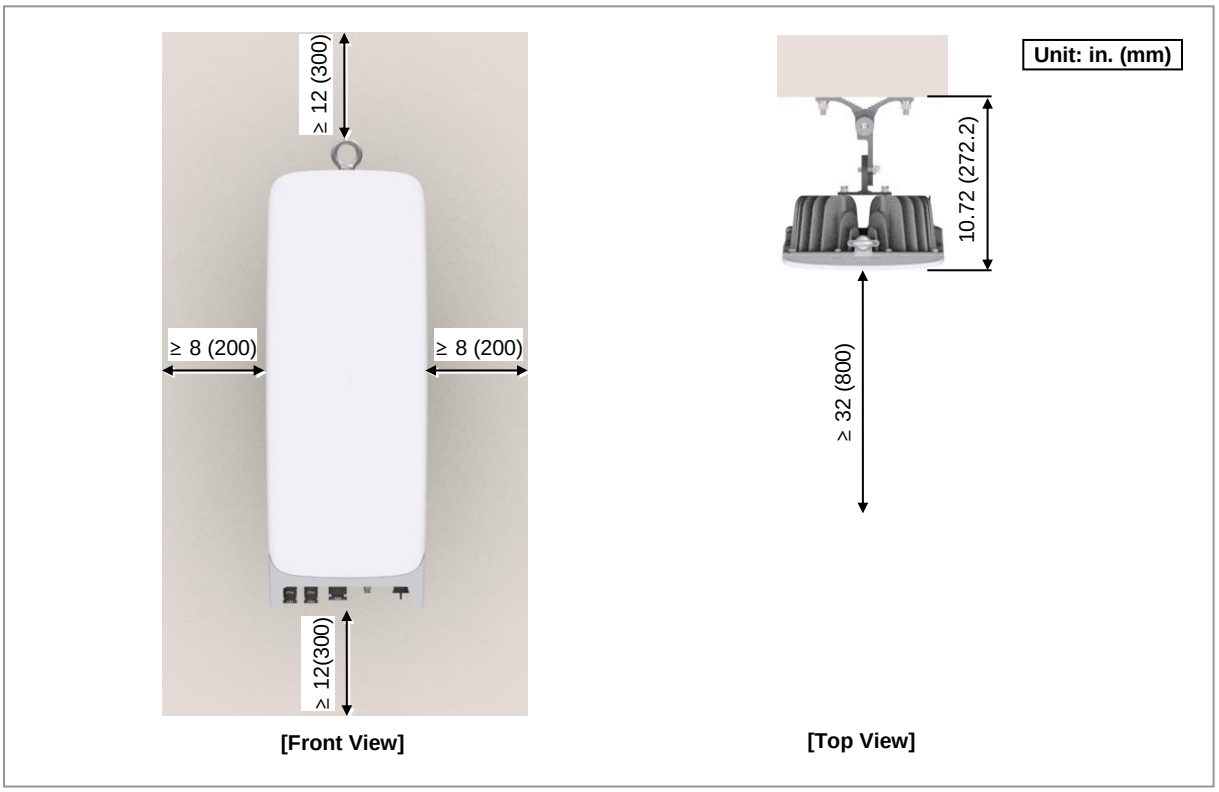


Figure 7. HRU Arrangement_Tilting

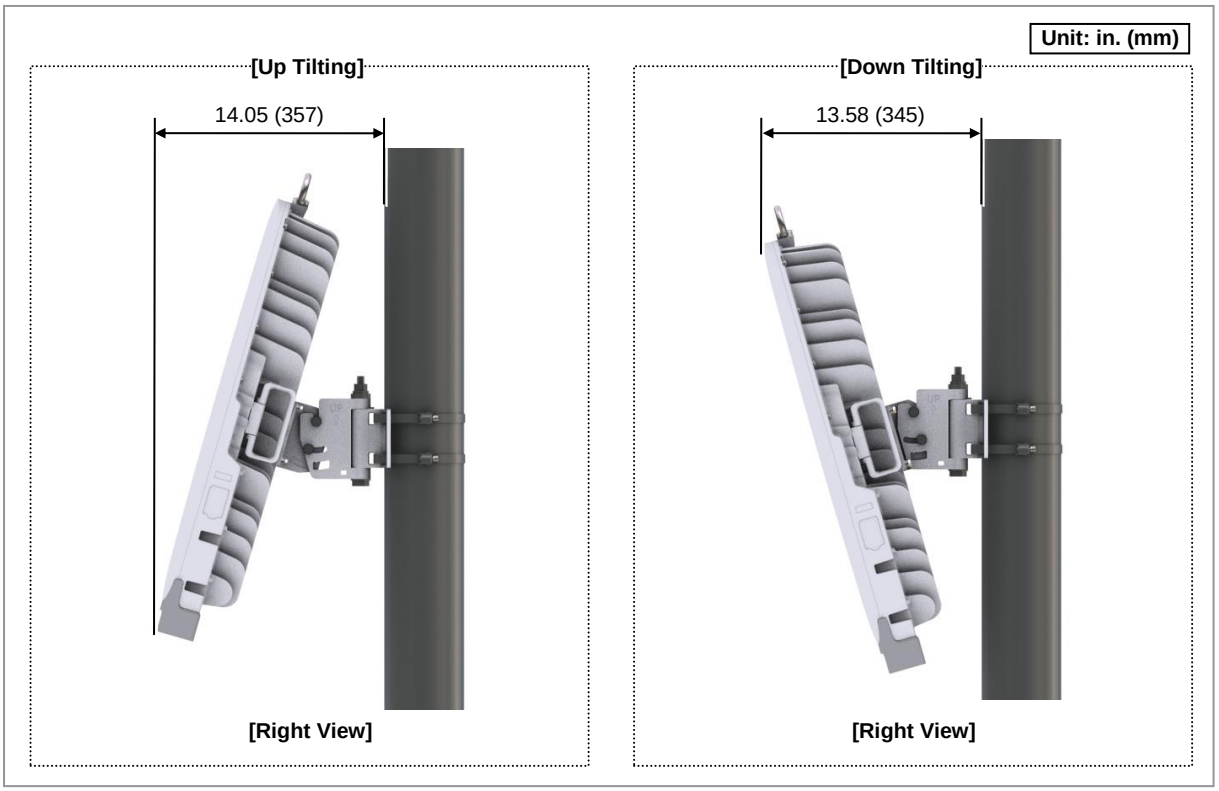
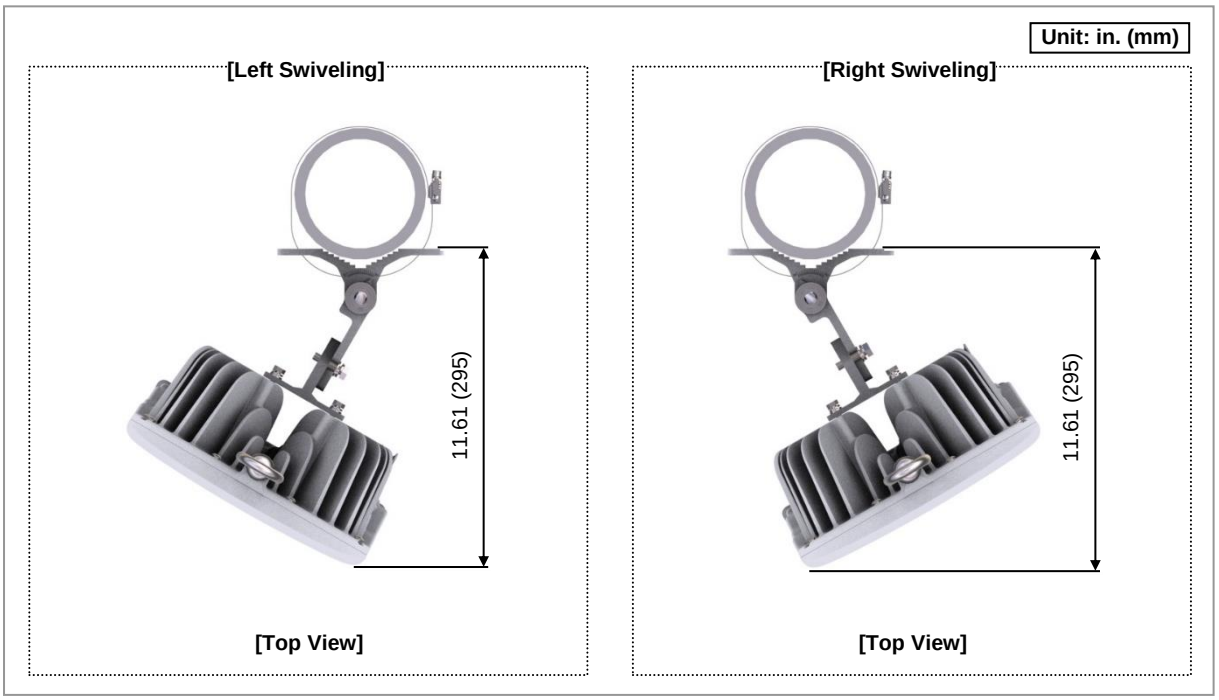


Figure 8. HRU Arrangement_Swiveling



Without Tilting Bracket

The figures below depict the recommended distances for each direction of the HRU without using the tilting bracket:

***Figure 9.** HRU Arrangement_1 Sector Pole Type Installation*

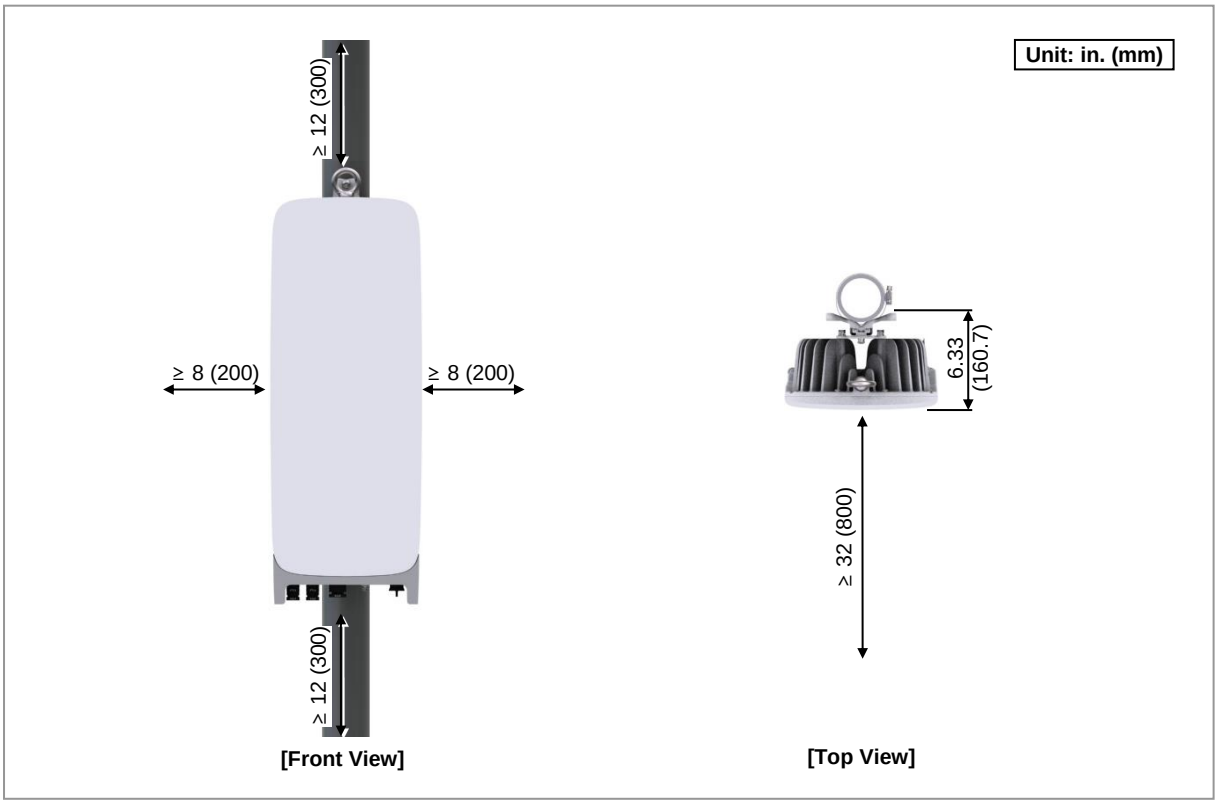
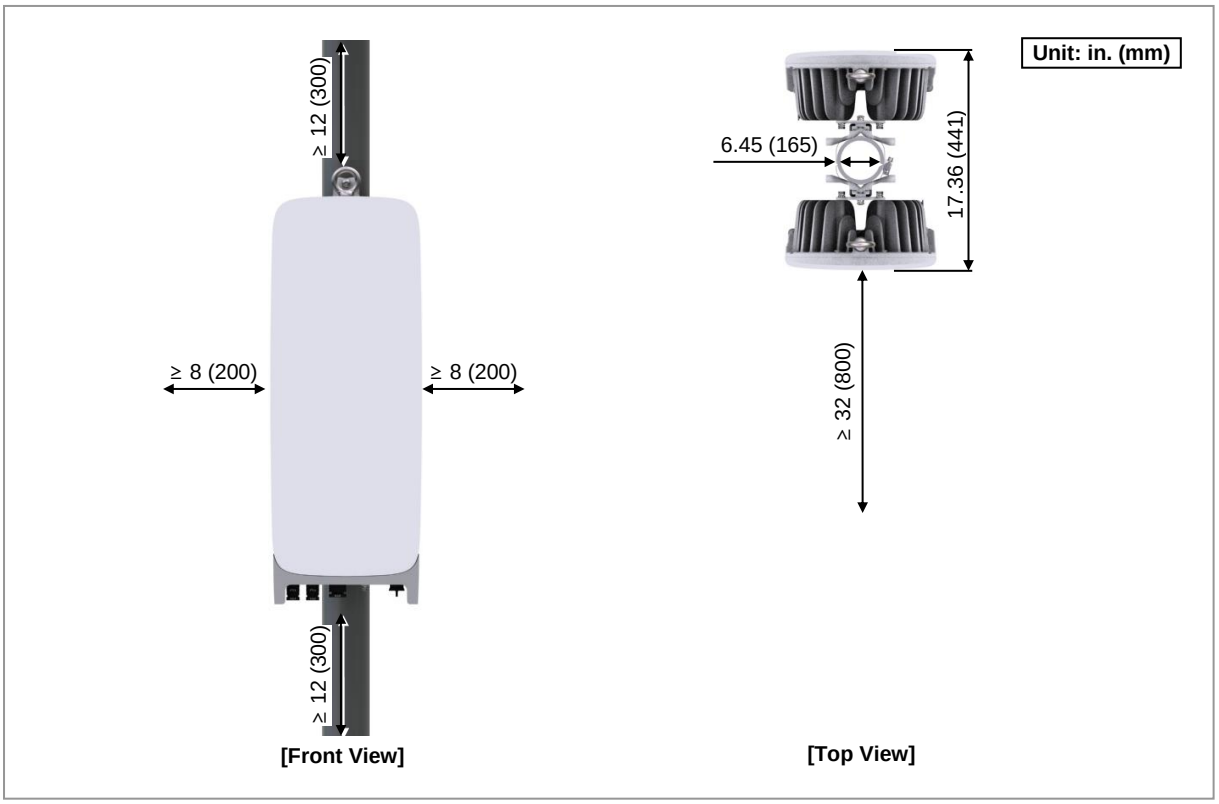


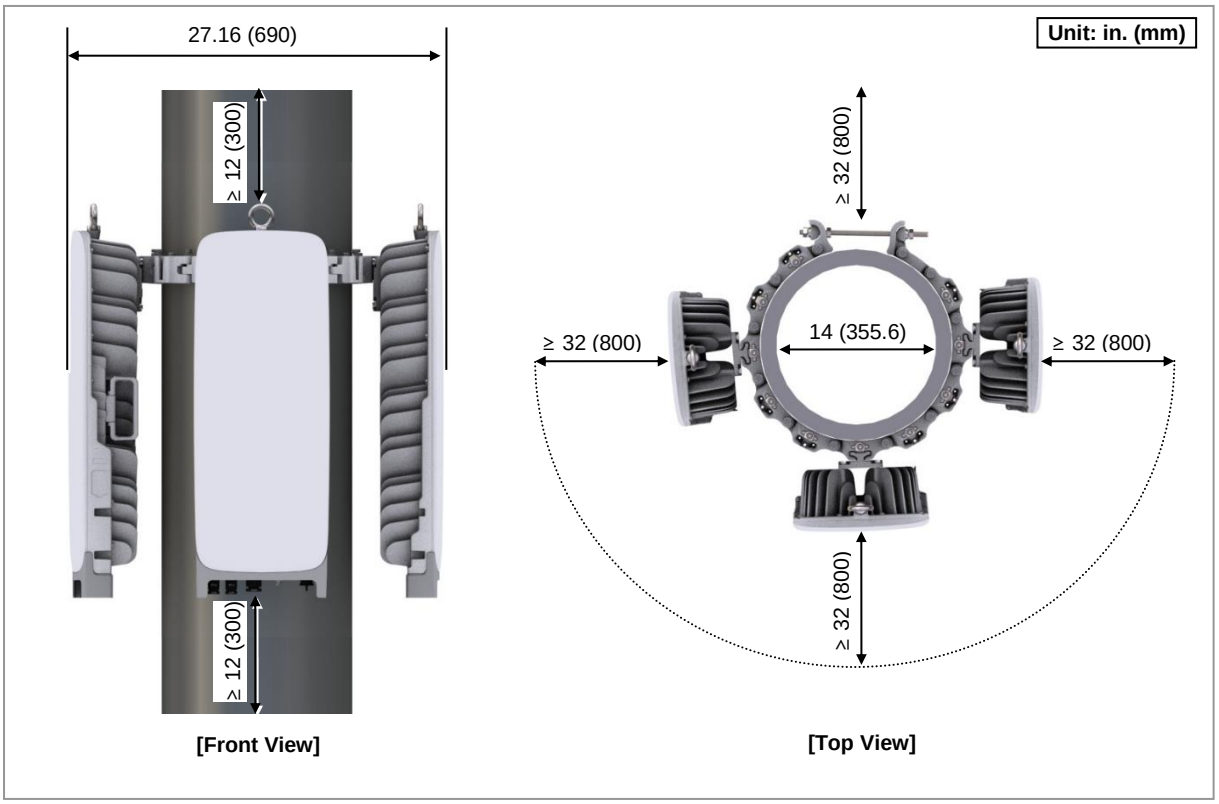
***Figure 10.** HRU Arrangement_2 Sector Pole Type Installation*



Using Chain Bracket

The figure below depicts the recommended distances for each direction of the HRU using the chain bracket:

Figure 11. ***HRU Arrangement_3 Sector Pole Type Installation***



Transporting and Unpacking

This section describes how to transport the items to the installation place and provides the procedure to unpack cabinets and other components.

Bringing in Items

Ensure the following at each stage of transportation of the items:

- Before moving a system, check storage place for the system and remove obstacles in advance.
- When carrying the system:
  - Fasten the system firmly to the transport vehicle or carrier to prevent damage to the system from a vibration or shock.
  - Use an elevator to prevent accidents. However, if the system must be carried by people, ensure there are enough people to carry the system.
- The system must not be shocked physically.
- The system should be protected from dust, moisture, and static electricity.

Unpacking

To unpack the items, ensure the following:

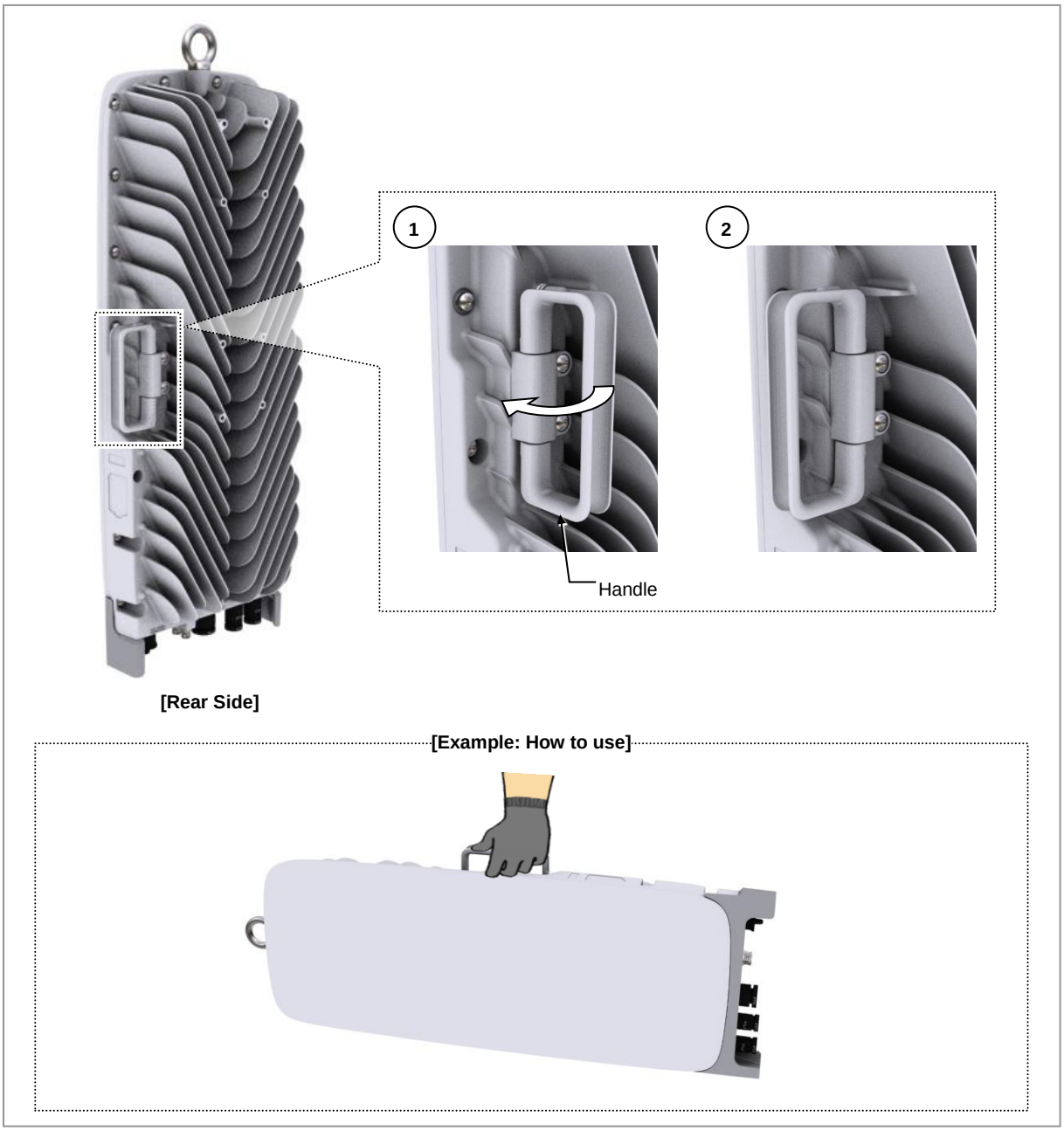
- The items must be packed until they reach the installation place.
- The items are classified in accordance with each job specification and stored at a place that does not interfere with working.
- Unpacked systems must be installed immediately. If immediate installation of the systems is not planned, the systems must be stored in the installation place temporarily.
- Unpack only external packing, leaving the internal packing in unpacked status.
- Unpack the inner packaging after each system is placed on its installation location.
- Dispose by-products (packaging waste) in accordance with waste management rules. Do not recycle the by-products.

HRU Handling

When transporting the HRU, hold the handle at the side of the HRU (no tool is needed for holding the handle.). After finishing the HRU fixation, turn the handle back.

The figure below depicts the position and direction of movement of the handle:

Figure 12. Using a Handle to transport an HRU



Fixing HRU

This section describes the procedures to fix the HRU by different methods.

Using Tilting and Swiveling Bracket

This section describes the procedure to fix the unit bracket using the tilting and swiveling bracket.

Fixing Unit Bracket

These instructions for mounting a unit bracket to the HRU apply to all installation types.

To fix the unit bracket, do the following:

Prerequisites

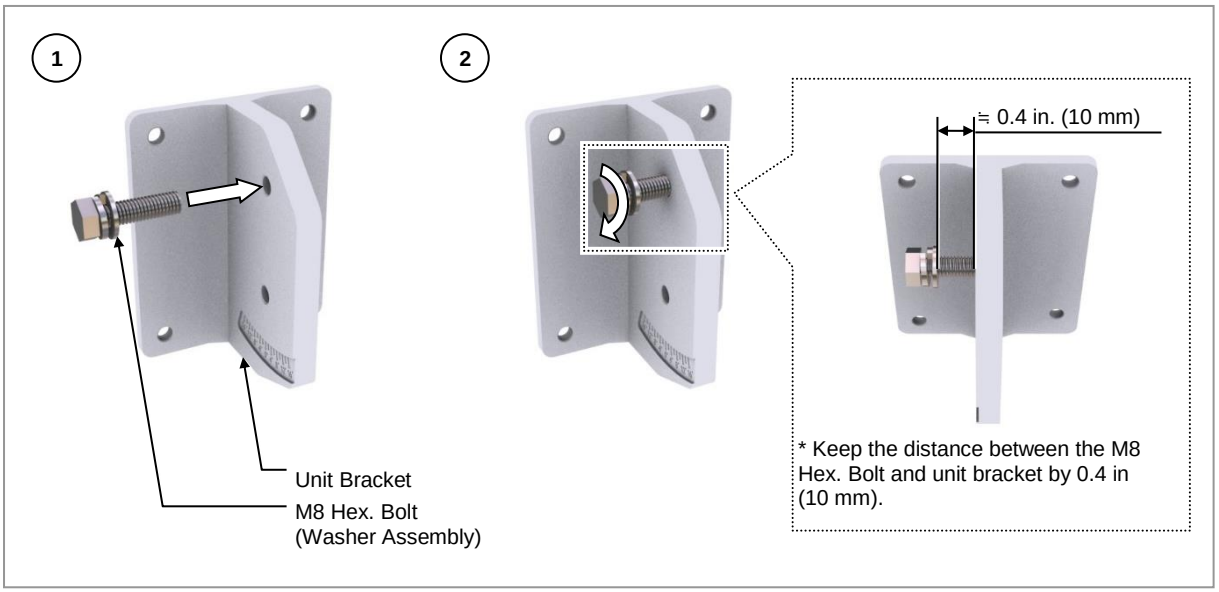
Before proceeding with fixing the unit bracket, make sure that you have the items mentioned in the table below:

Table 3. Parts and Tools for Fixing Unit Bracket on HRU

Category	Description		
Parts	Unit Bracket		1 EA/HRU
	Fasteners	M6 × L20 hexagonal bolt (Washer assembly)	4 EA/HRU
		M8 × L30 hexagonal bolt (Washer assembly)	1 EA/HRU
Recommended Torque Value	M6 Hex. Bolt		43 lbf·in (50 kgf·cm)
Working Tools	• Torque Wrench (10 to 50 lbf·in) • Torque Wrench Spanner Head (apply hexagonal head: 10 mm) • Spanner (apply hexagonal head: 13 mm)		

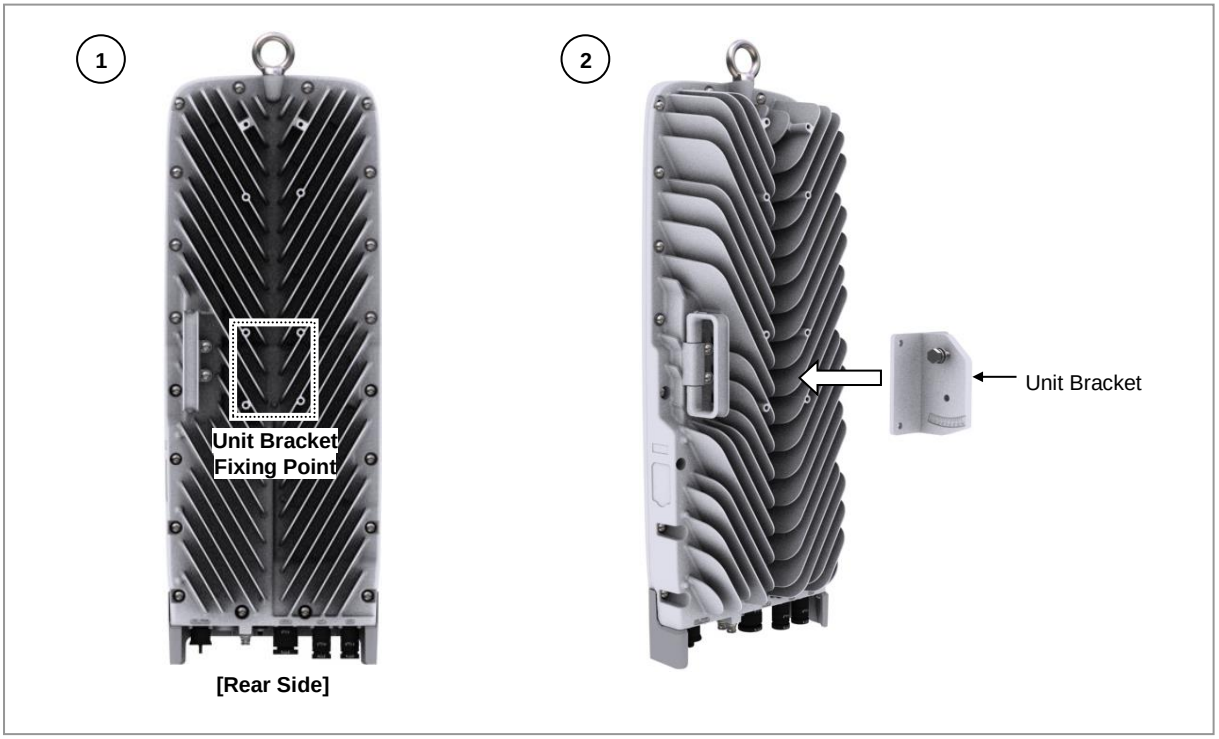
1 Inset the M8 hexagonal bolt to the unit bracket temporarily.

Figure 13. Fixing Unit Bracket (1)



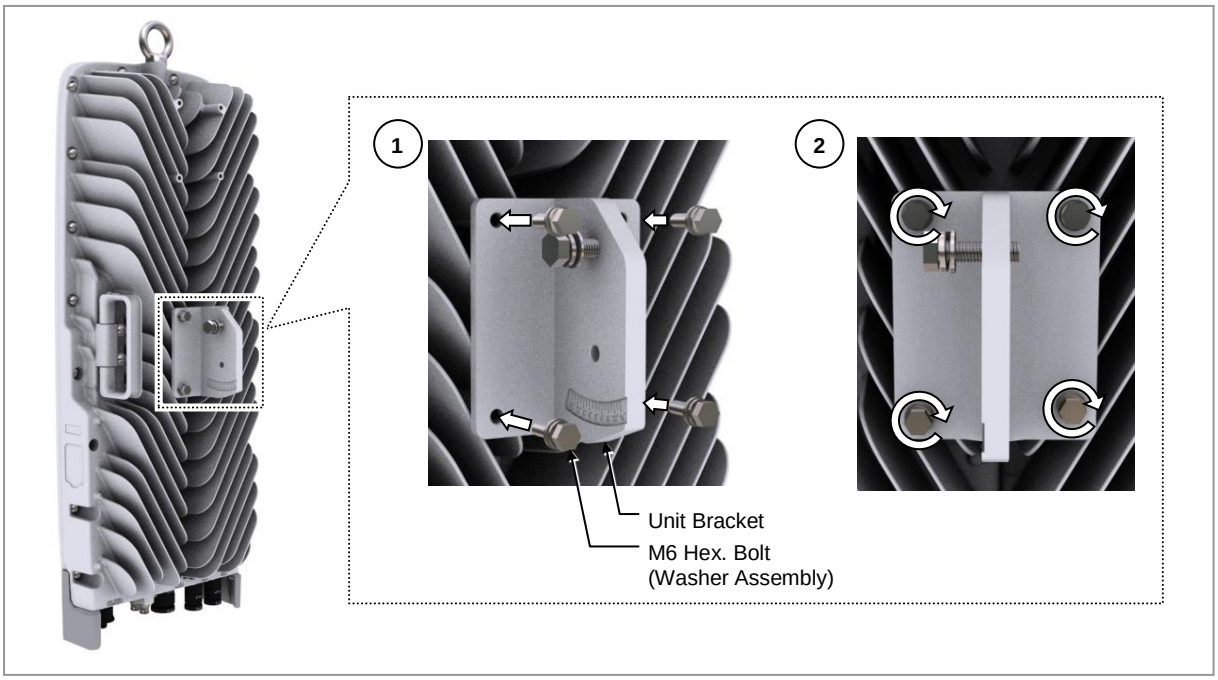
2 Check the position for mounting the unit bracket on the back of the HRU and place it in that position.

Figure 14. Fixing Unit Bracket (2)



3 Fix the unit bracket using fasteners.

Figure 15. Fixing Unit Bracket (3)



Fixing Pole Type

This section describes the procedures for fixing the system on the pole.

The standard of the pole on which the mounting bracket can be attached using steel bands is 50 A to 150 A (250 A is optional).

Assembling Mounting Bracket for 1 Sector

To assemble the mounting bracket for 1 sector, do the following:

Prerequisites

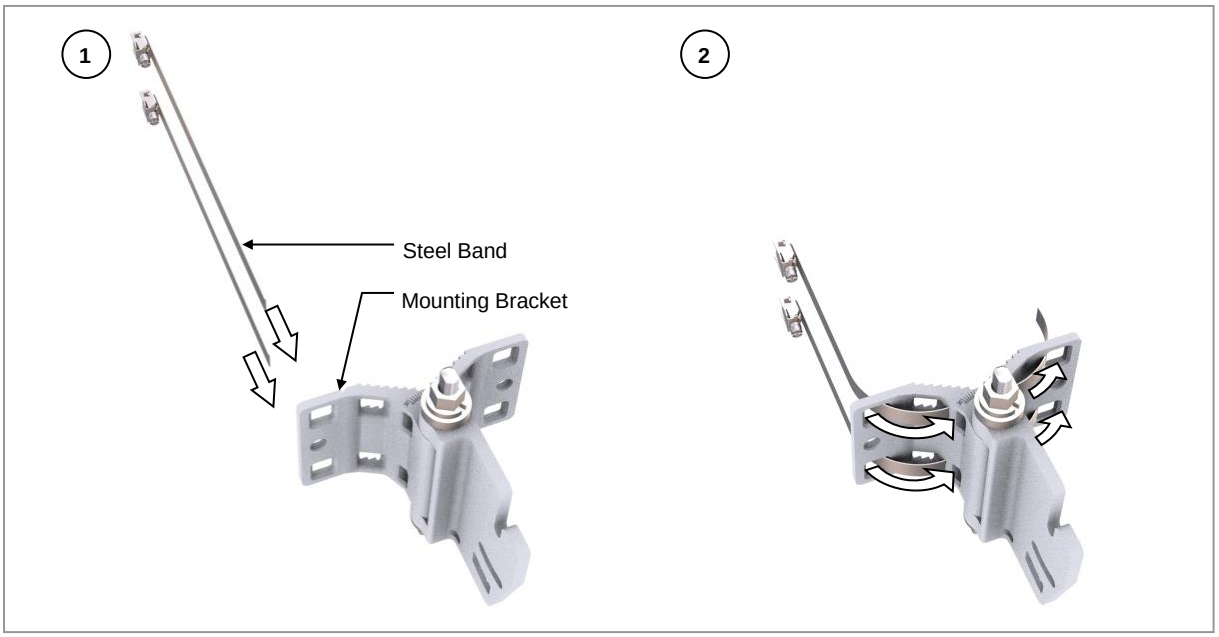
Before proceeding with assembling the mounting bracket for 1-sector, make sure that you have the items mentioned in the table below:

Table 4. Parts and Tools for Fixing Mounting Bracket on the Pole

Category	Description		
Parts	Mounting Bracket		1 EA
	Fasteners	Steel Band	2 EA
Recommended Torque Value	Steel Band Fixing Screw		48.5 lbf·in (56.1 kgf·cm)
Working Tools	• Torque Driver (20 to 90 lbf·in) • Screw Driver Bit ('+', No. 3) • Compass		

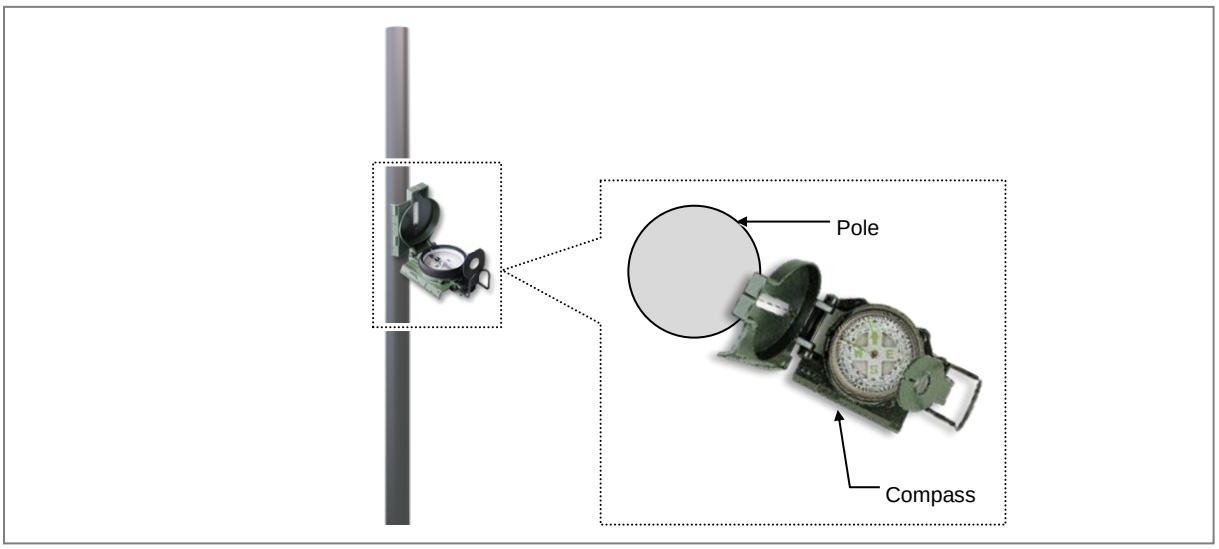
1 Pass the steel band through the fixing hole of the mounting bracket.

Figure 16. Fixing Mounting Bracket on the Pole (1)



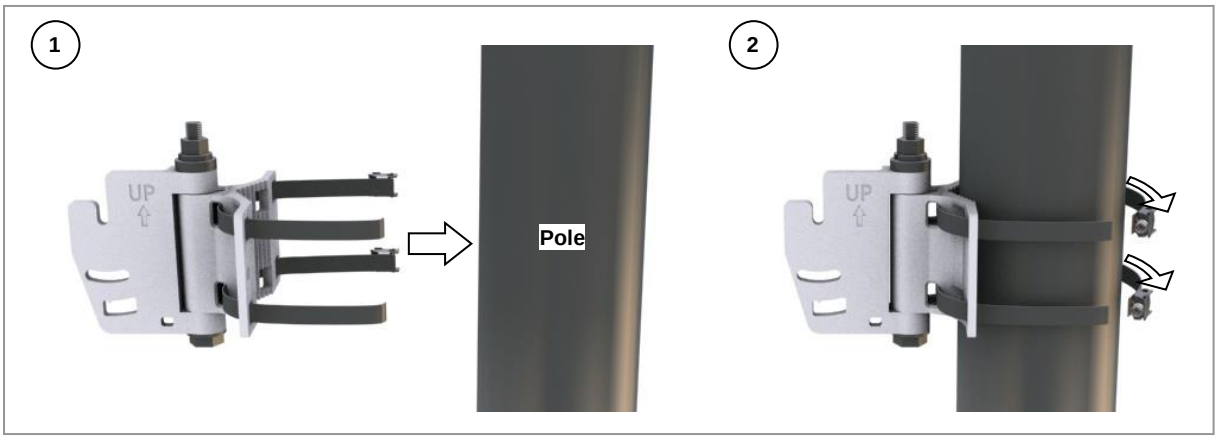
2 Use a compass to determine the azimuth of the HRU to be installed on the pole.

Figure 17. Fixing Mounting Bracket on the Pole (2)



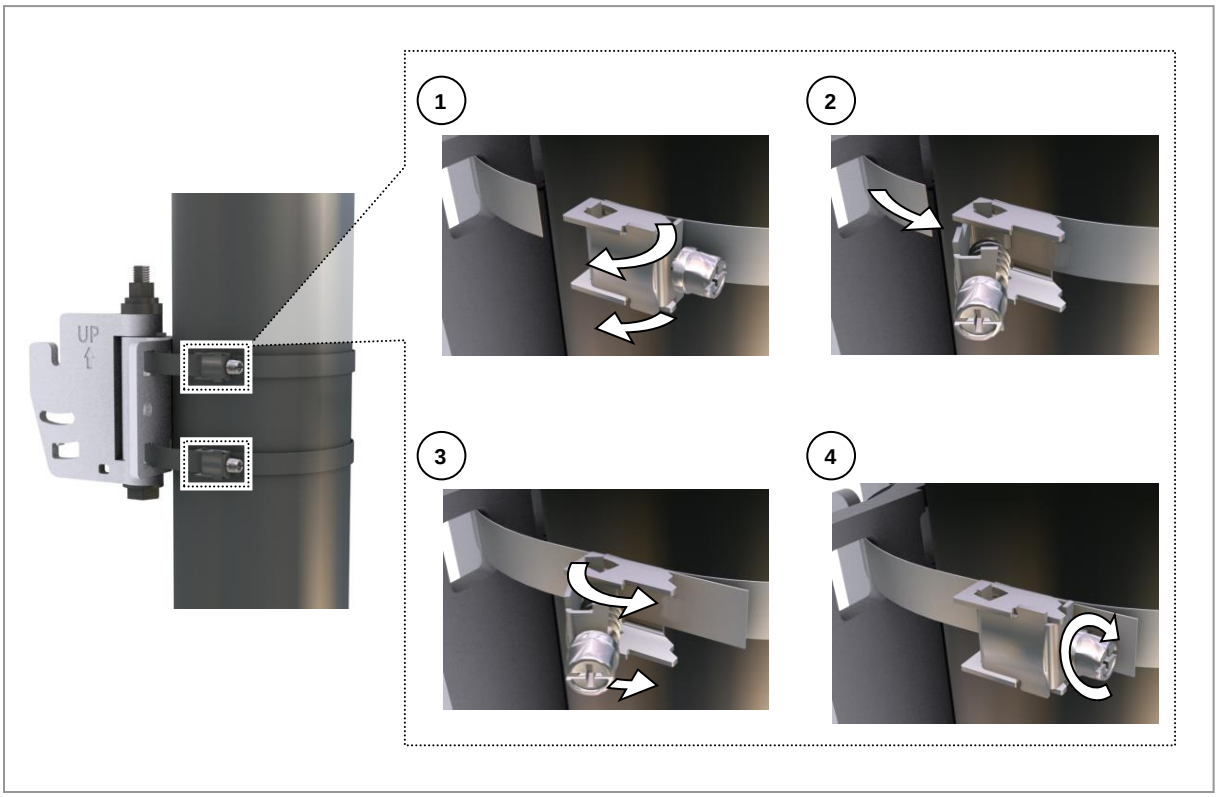
3 Place a mounting bracket to the pole.

Figure 18. Fixing Mounting Bracket on the Pole (3)



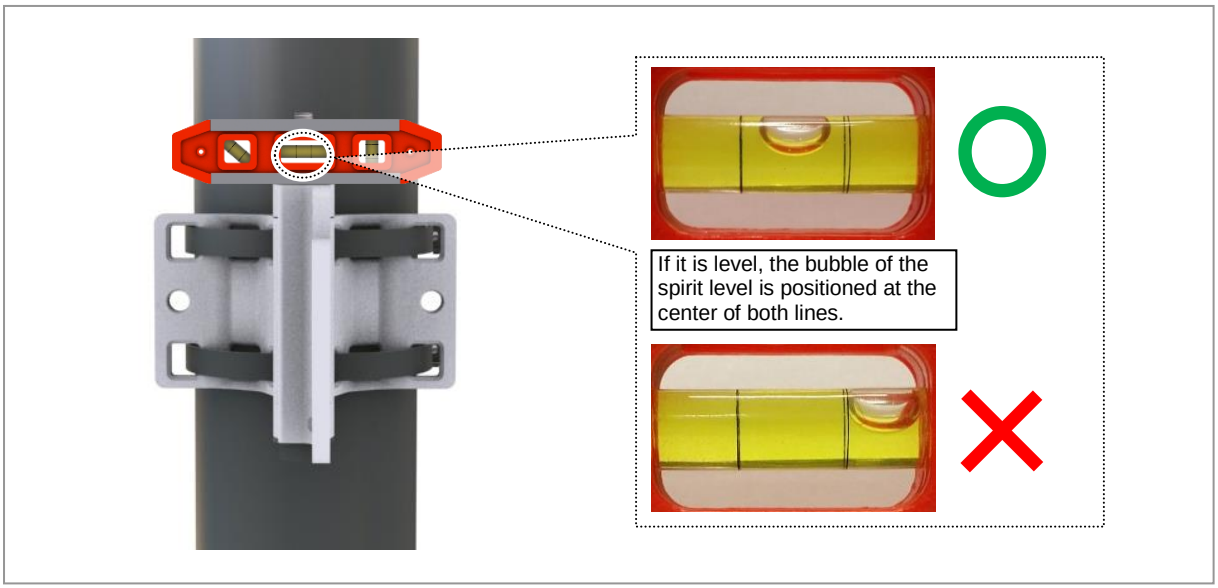
4 Fix the mounting bracket to the pole using the steel band.

Figure 19. Fixing Mounting Bracket on the Pole (4)



5 Check the level of mounting bracket on the pole and adjust the level.

Figure 20. Fixing Mounting Bracket on the Pole (5)



When fixing the mounting bracket on the pole, be sure to check the level of bracket. After finishing the installation, adjust the level minutely.

When poor leveling happens, adjust the position of fasteners used to fix the mounting bracket.

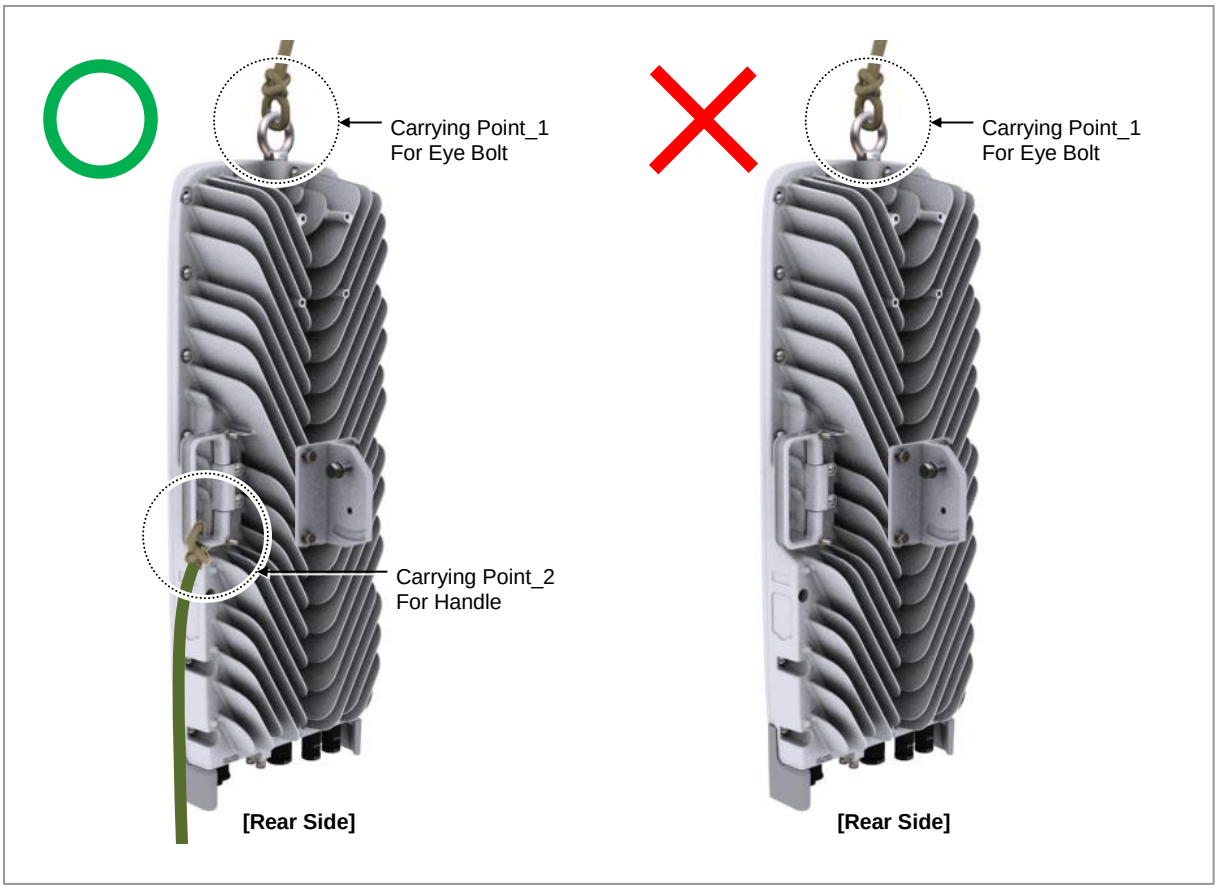
After fixing the steel band, push the remainder of band inside the mounting bracket

Lifting HRU

To lift the HRU, do the following:

1 Tie the rope in two carrying points of HRU.

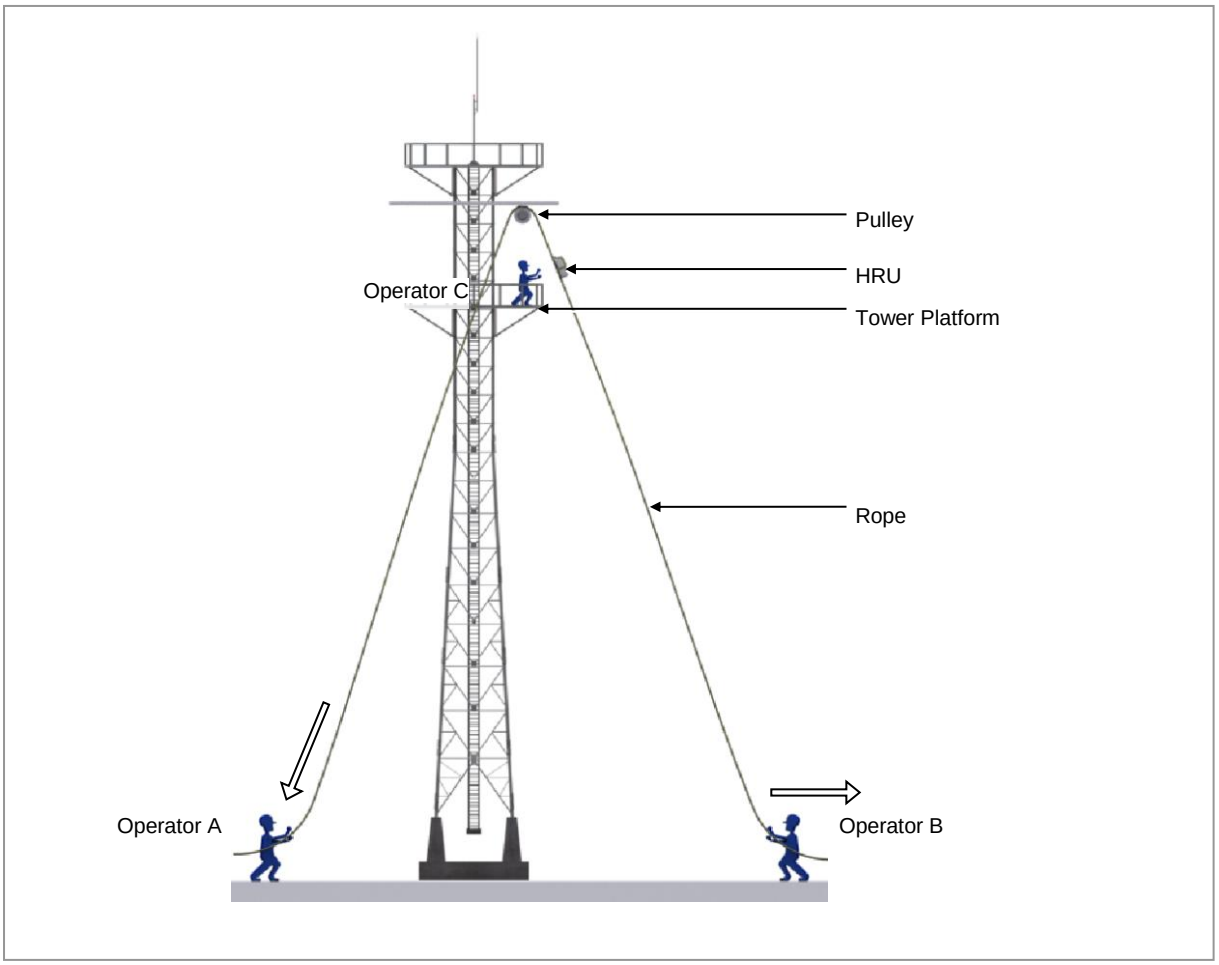
***Figure 21.** Lifting HRU (1)*



2 While Operator A hauls the rope to carry up the HRU, Operator B pulls the rope outward, so that HRU would not hit the tower platform.

3 Operator C locates the carried HRU to the installation position.

Figure 22. Lifting HRU (2)



Fixing HRU on the Pole

To fix the HRU on the pole, do the following:

Prerequisites

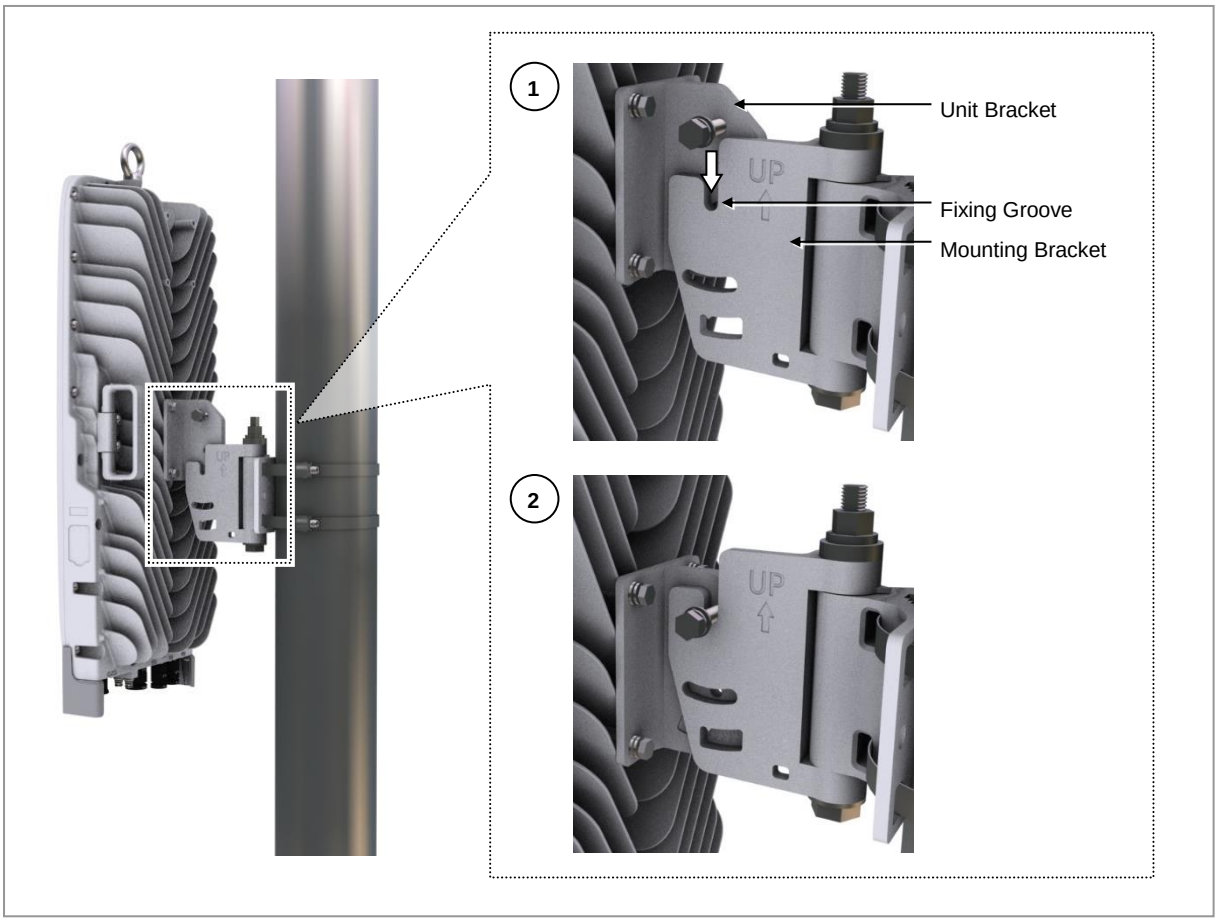
Before proceeding with fixing the HRU on the pole, make sure that you have the items mentioned in the table below:

Table 5. Parts and Tools for Fixing HRU on the Pole

Category	Description	
Fasteners	M8 × L30 hexagonal bolt (Washer assembly)	1 EA
Recommended Torque Value	M8 hexagonal bolt	110 lbf·in (127 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagon head: 13 mm) • Compass	

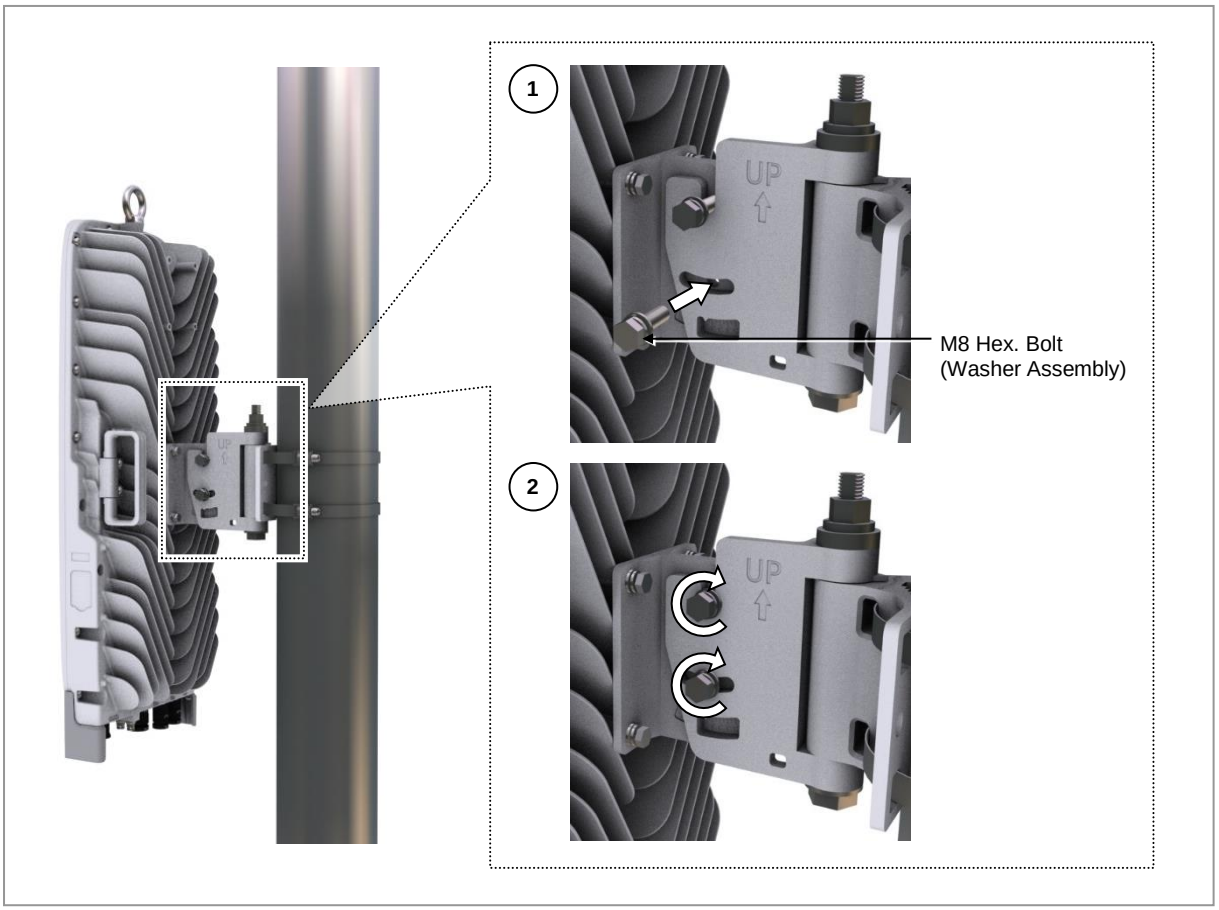
1 Place the unit bracket on the fixing groove of the mounting bracket.

Figure 23. Fixing HRU on the Pole (1)

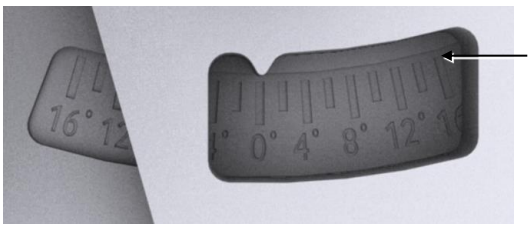


2 Fix the HRU using fasters.

Figure 24. Fixing HRU on the Pole (2)



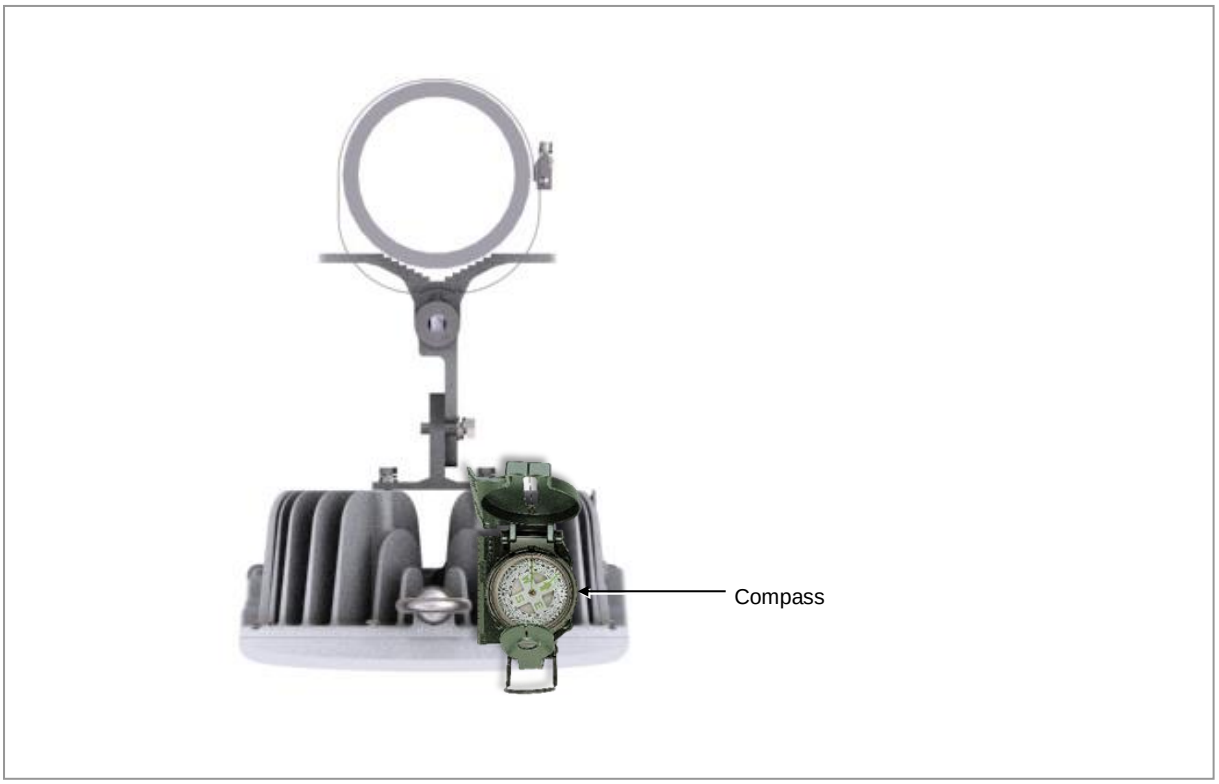
When installing the HRU, the tilting angle pointer of the unit bracket should point to 0°.



[Angle pointer position for unit bracket with 0° tilt when installing the HRU]

3 Use the compass to check the azimuth of the front of the HRU.

Figure 25. Fixing HRU on the Pole (3)



Assembling Mounting Bracket for 2 Sector

To assemble the mounting bracket for 2- sector, do the following:

Prerequisites

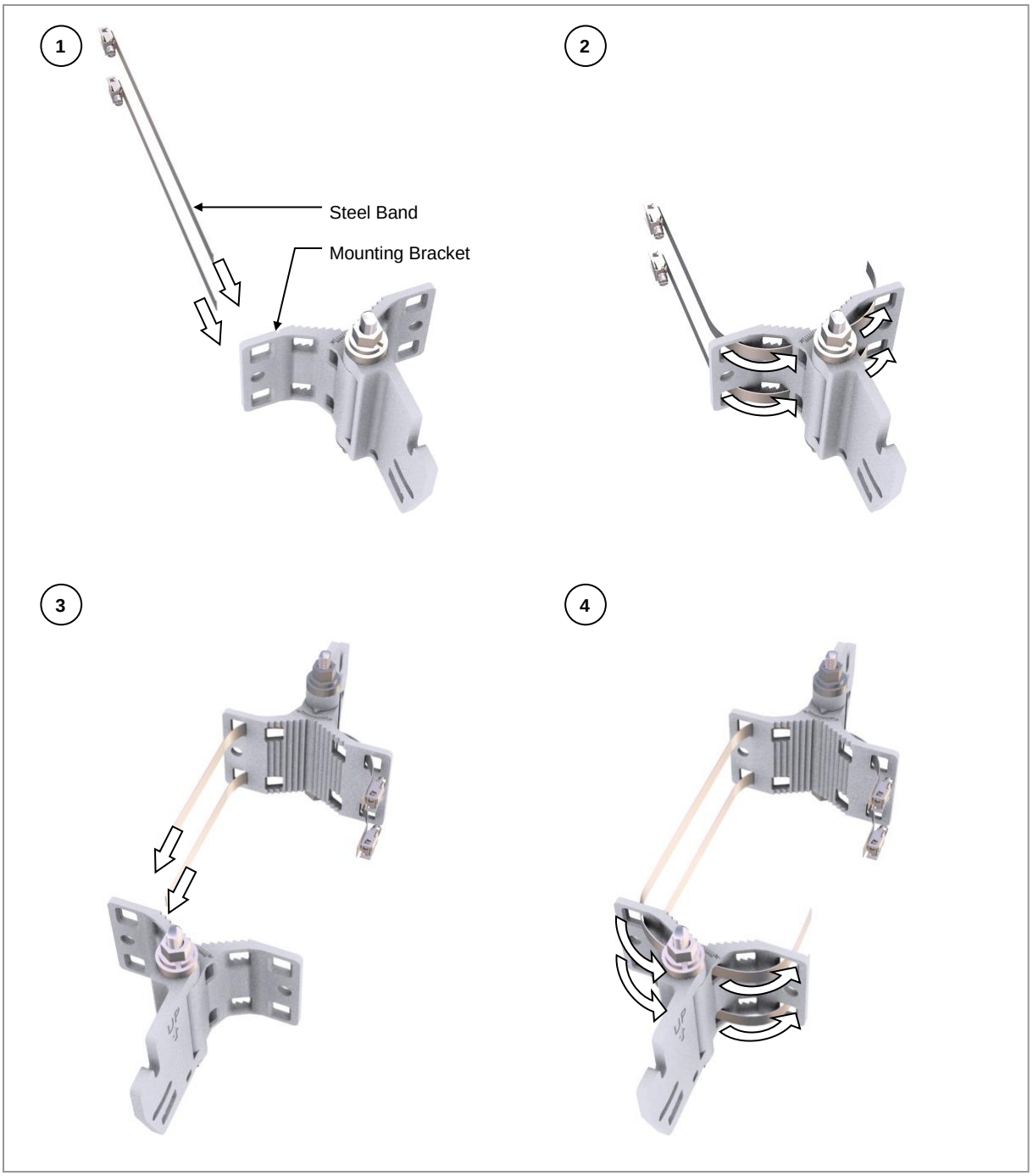
Before proceeding with assembling the mounting bracket for 2-sector, make sure that you have the items mentioned in the table below:

Table 6. Parts and Tools for Fixing Mounting Bracket on the Pole

Category	Description		
Parts	Mounting Bracket		2 EA
	Fasteners	Steel Band	2 EA
Recommended Torque Value	Steel Band Fixing Screw		48.5 lbf·in (56.1 kgf·cm)
Working Tools	• Torque Driver (20 to 90 lbf·in) • Screw Driver Bit ('+', No. 3) • Compass		

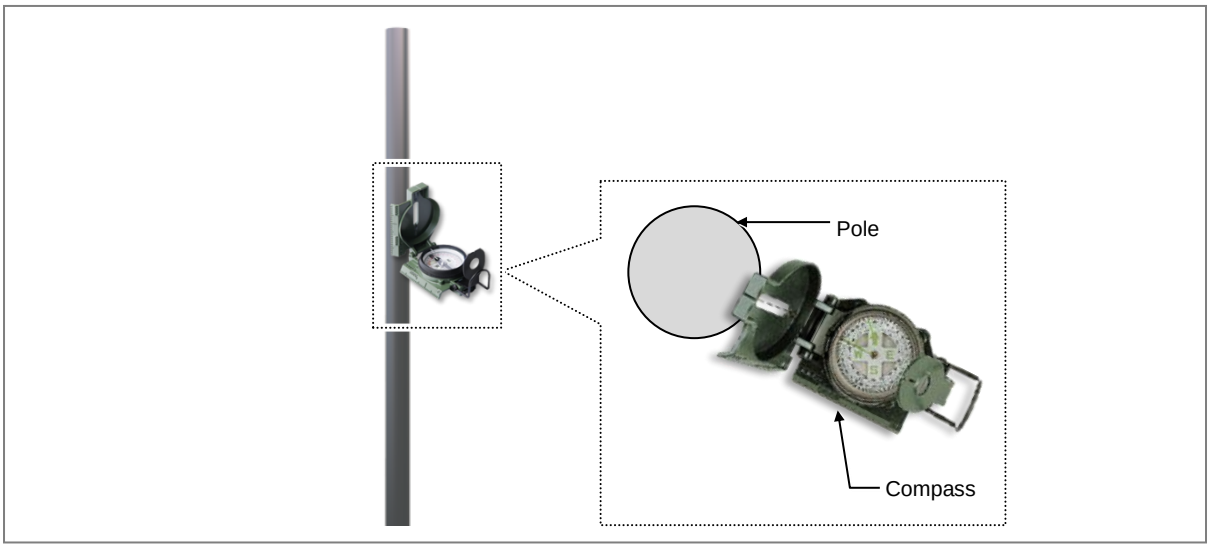
1 Pass the steel band through the fixing hole of the mounting brackets.

Figure 26. Fixing Mounting Bracket on the Pole (1)



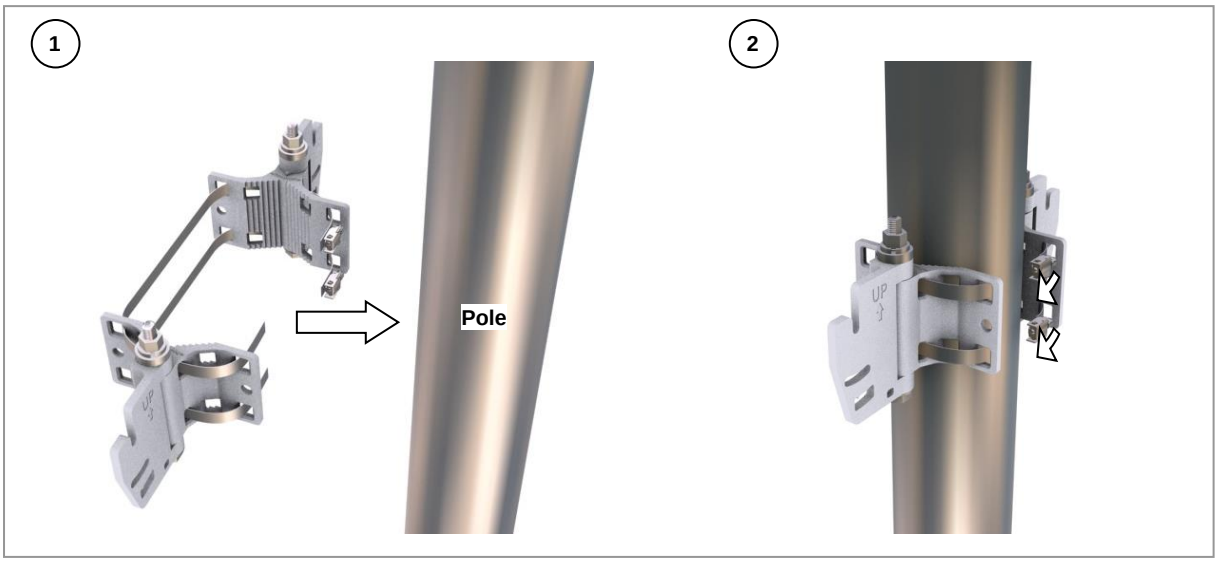
2 Use a compass to determine the azimuth of the HRU to be installed on the pole.

Figure 27. Fixing Mounting Bracket on the Pole (2)



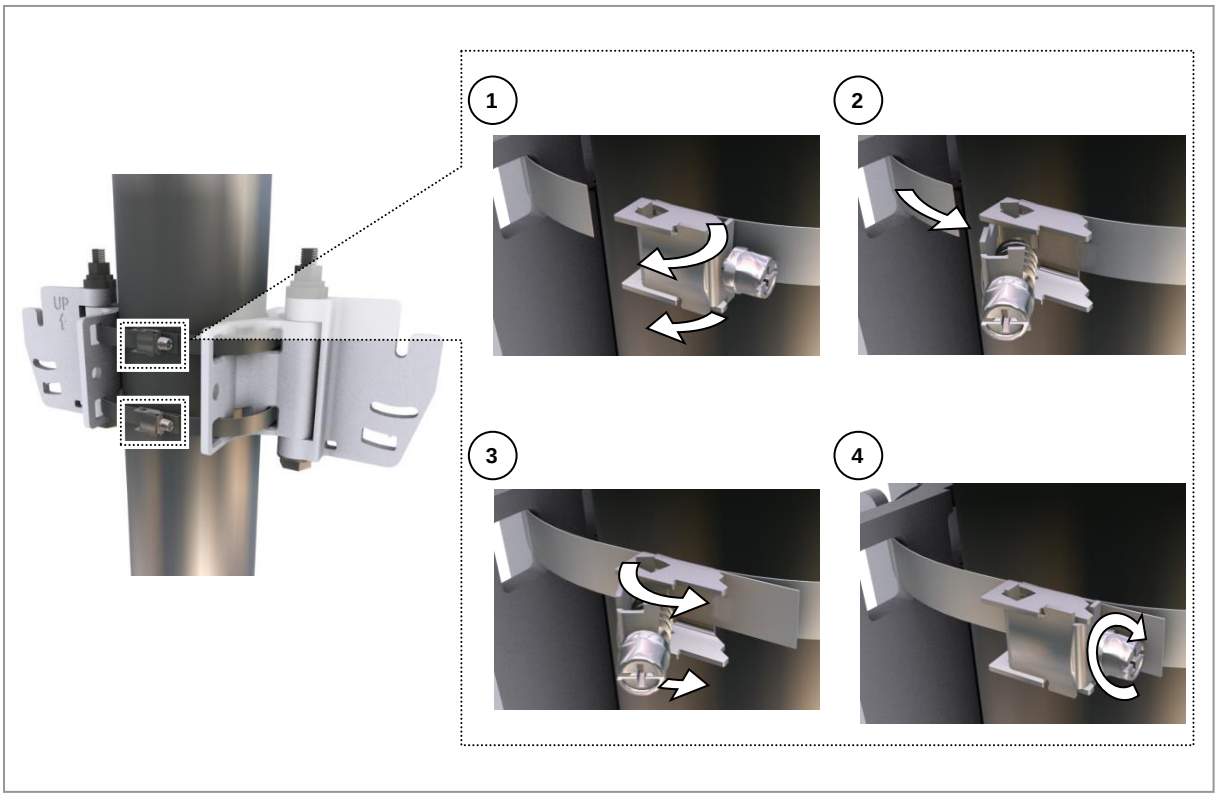
3 Place mounting brackets to the pole.

Figure 28. Fixing Mounting Bracket on the Pole (3)



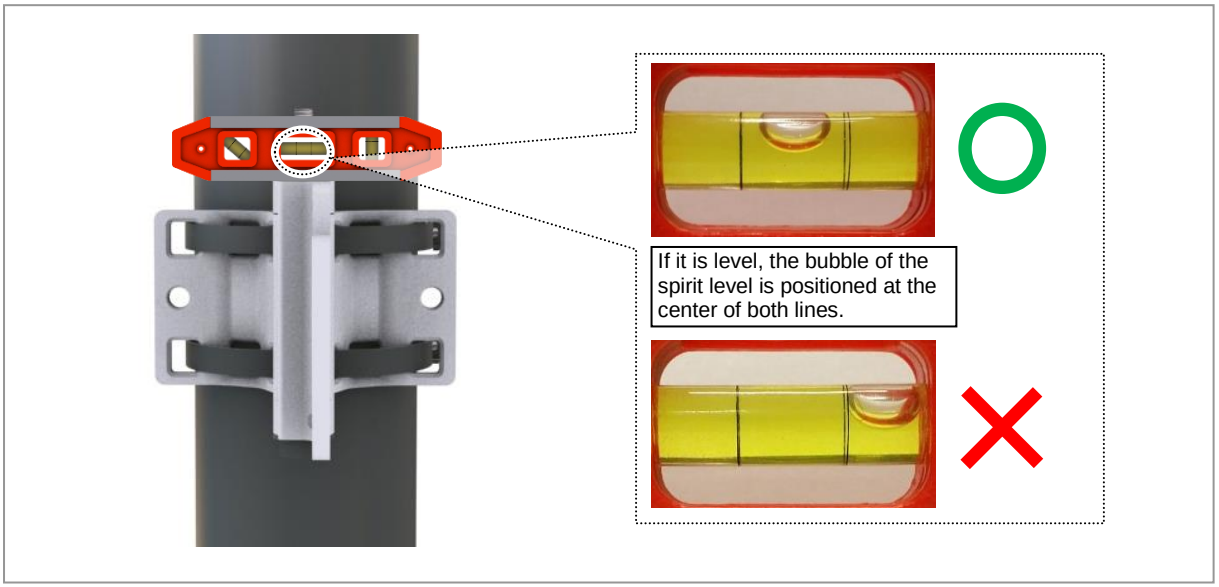
4 Fix the mounting brackets to the pole using the steel band.

Figure 29. Fixing Mounting Bracket on the Pole (4)



5 Check the level of each mounting brackets on the pole and adjust the level.

Figure 30. Fixing Mounting Bracket on the Pole (5)



When fixing the mounting bracket on the pole, ensure to check the level of bracket. After finishing the installation, adjust the level minutely.

When poor leveling happens, adjust the position of fasteners to fix the mounting bracket.

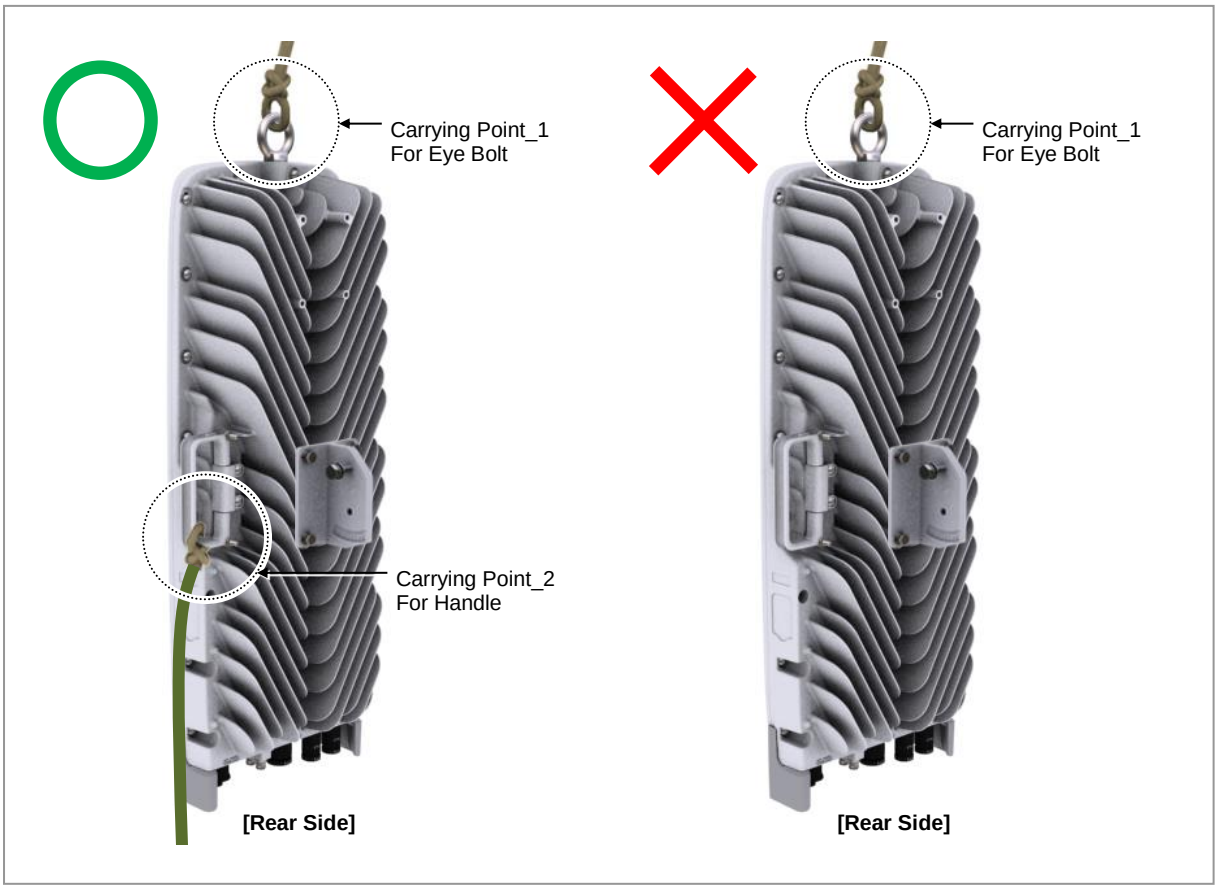
After fixing the steel band, push the remainder of band inside the mounting bracket

Lifting HRU

To lift the HRU, do the following:

1 Tie the rope in two carrying points of HRUs.

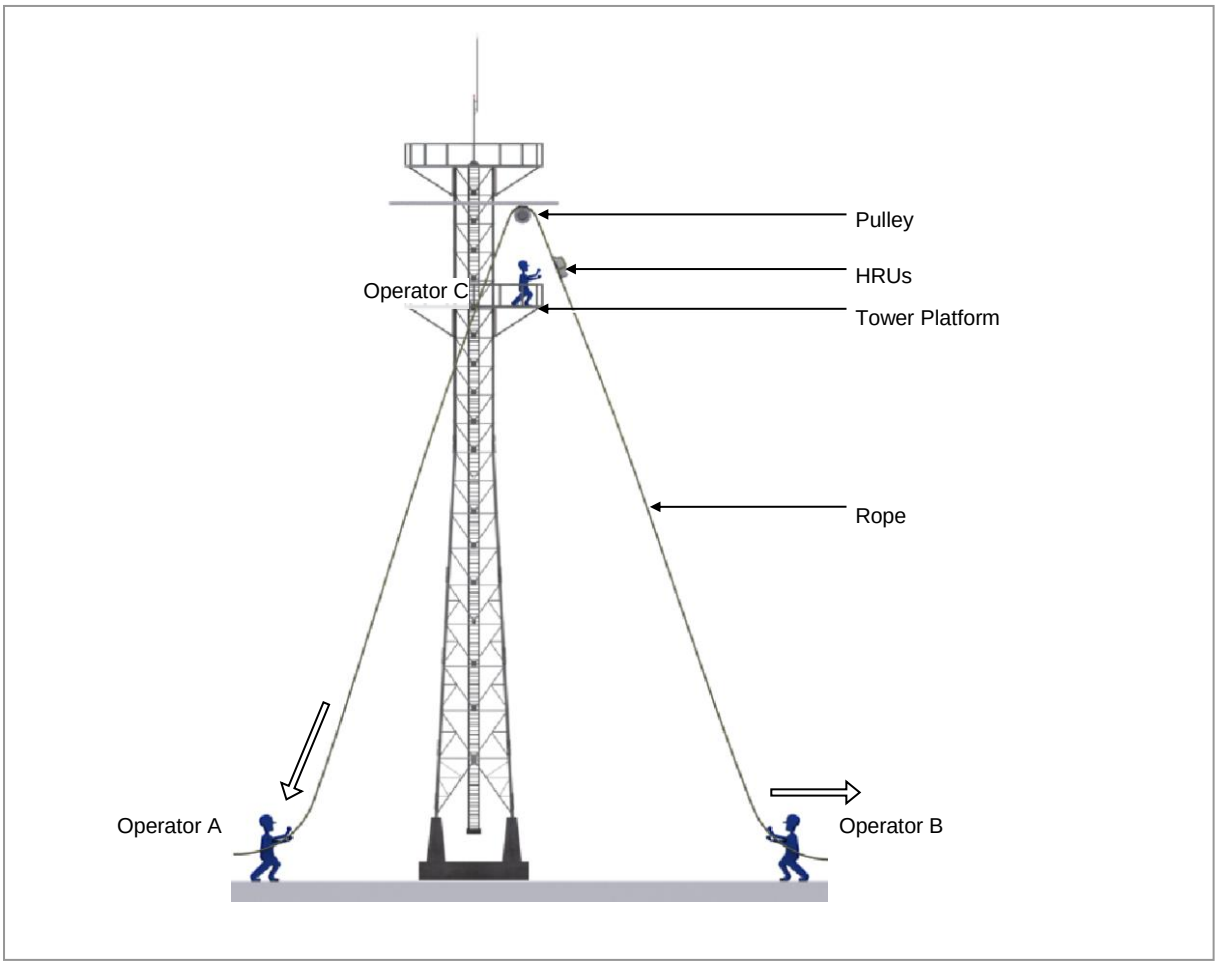
Figure 31. Lifting HRUs (1)



2 While Operator A hauls the rope to carry up the HRUs, Operator B pulls the rope outward, so that HRUs do not hit the tower platform.

3 Operator C locates the carried HRU to the installation position.

Figure 32. Lifting HRUs (2)



Fixing HRUs on the Pole

To fix the HRU on the pole, do the following:

Prerequisites

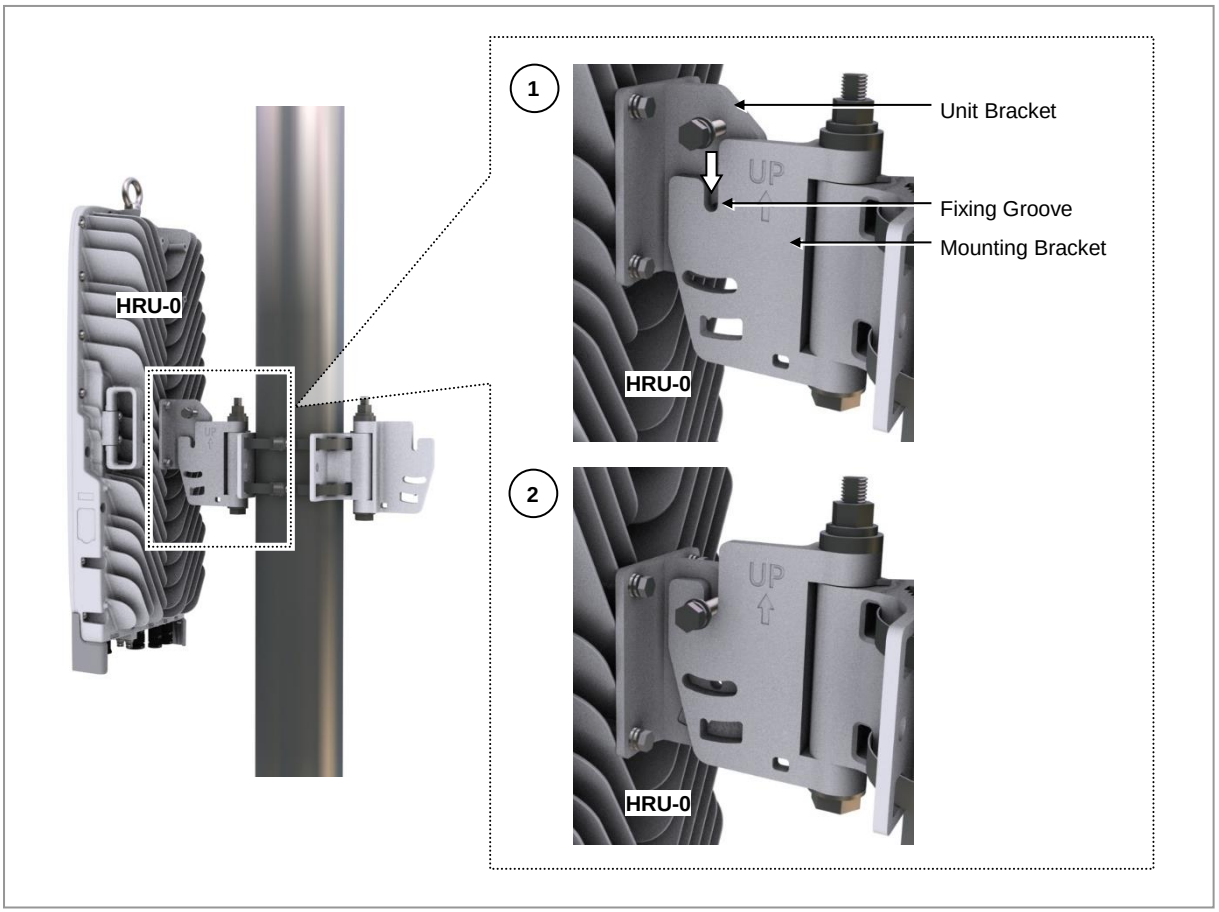
Before proceeding with fixing the HRU on the pole, make sure that you have items mentioned in the following table.

Table 7. Parts and Tools for Fixing HRU on the Pole

Category	Description	
Fasteners	M8 × L30 hexagonal bolt (Washer assembly)	1 EA/HRU
Recommended Torque Value	M8 hexagonal bolt	110 lbf·in (127 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagonal head: 13 mm) • Compass	

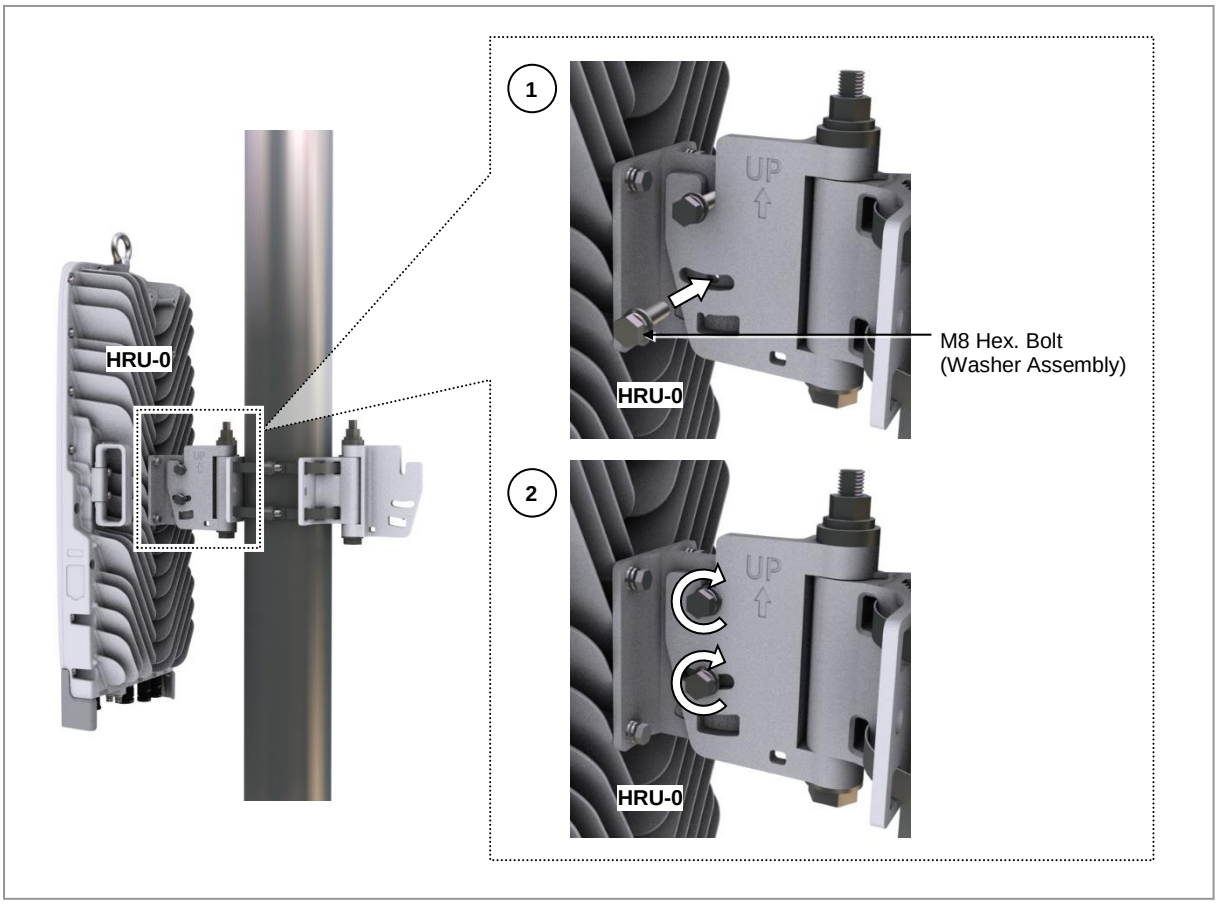
1 Place the unit bracket of HRU-0 on the fixing groove of the mounting bracket.

***Figure 33.** Fixing HRUs on the Pole (1)*

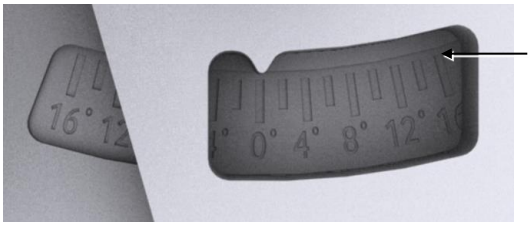


2 Fix the HRU-0 using the fasters.

Figure 34. Fixing HRUs on the Pole (2)



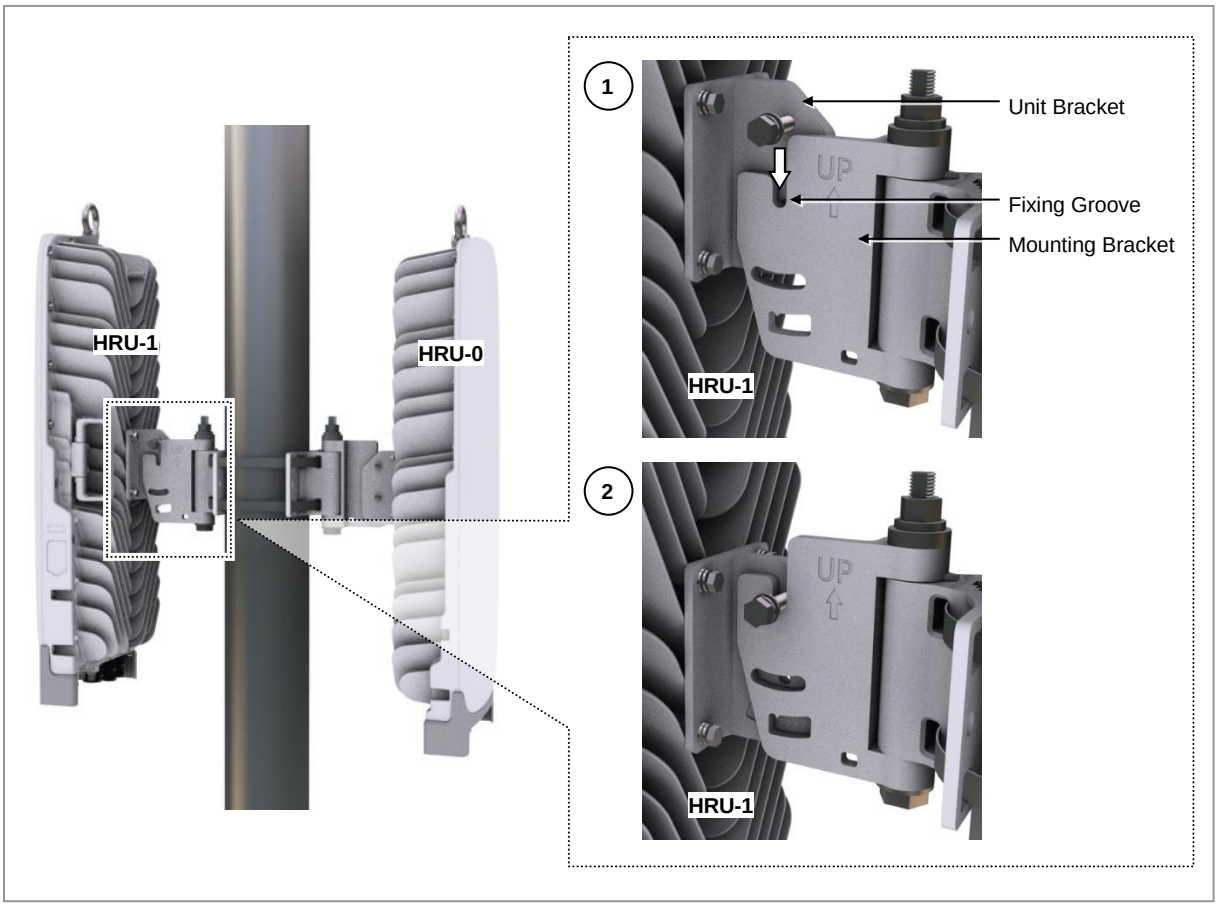
When installing the HRU, the tilting angle pointer of the unit bracket should point to 0°.



[Angle pointer position for unit bracket with 0° tilt when installing the HRU]

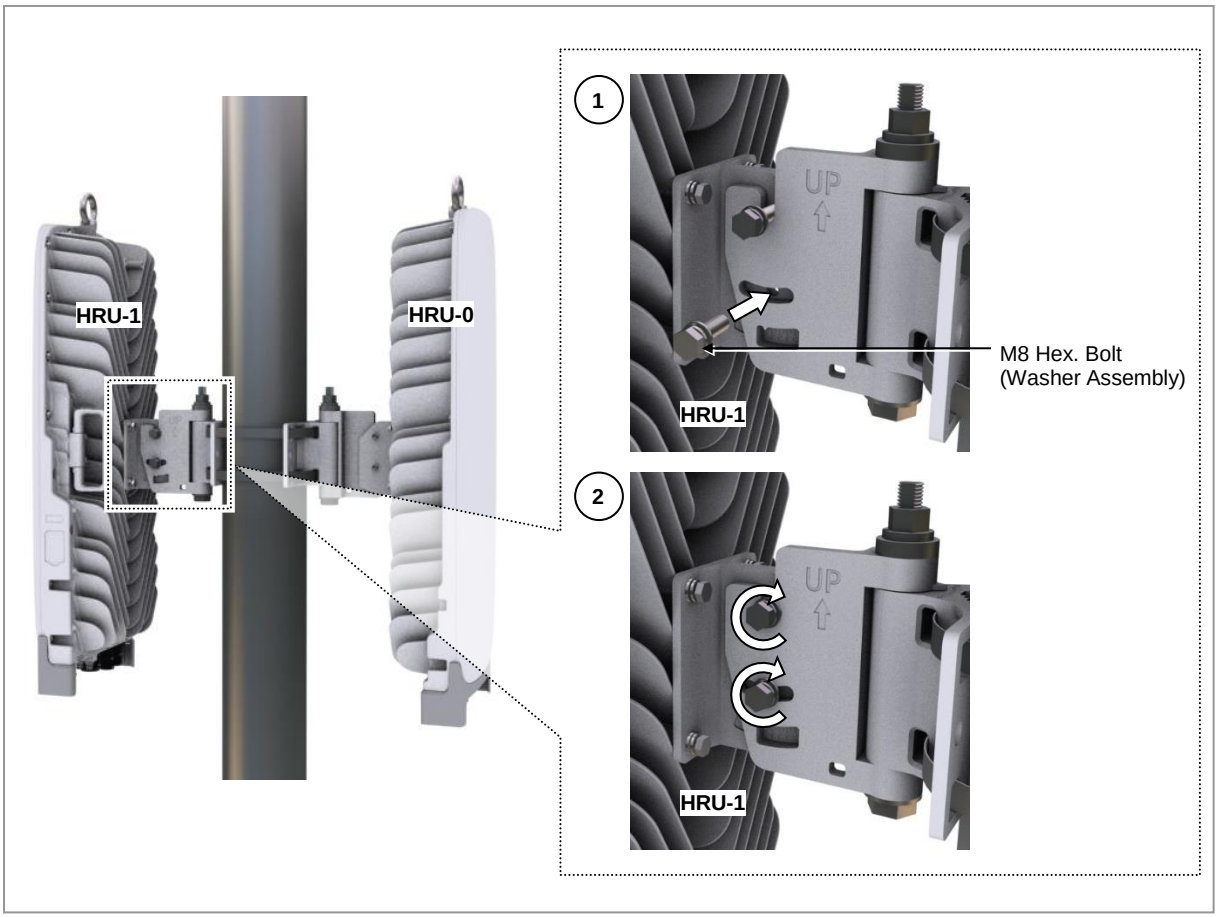
3 Place the unit bracket of HRU-1 on the fixing groove of the mounting bracket.

Figure 35. Fixing HRUs on the Pole (3)

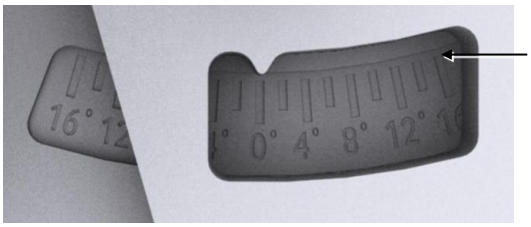


4 Fix the HRU-1 using the fasters.

Figure 36. Fixing HRUs on the Pole (4)



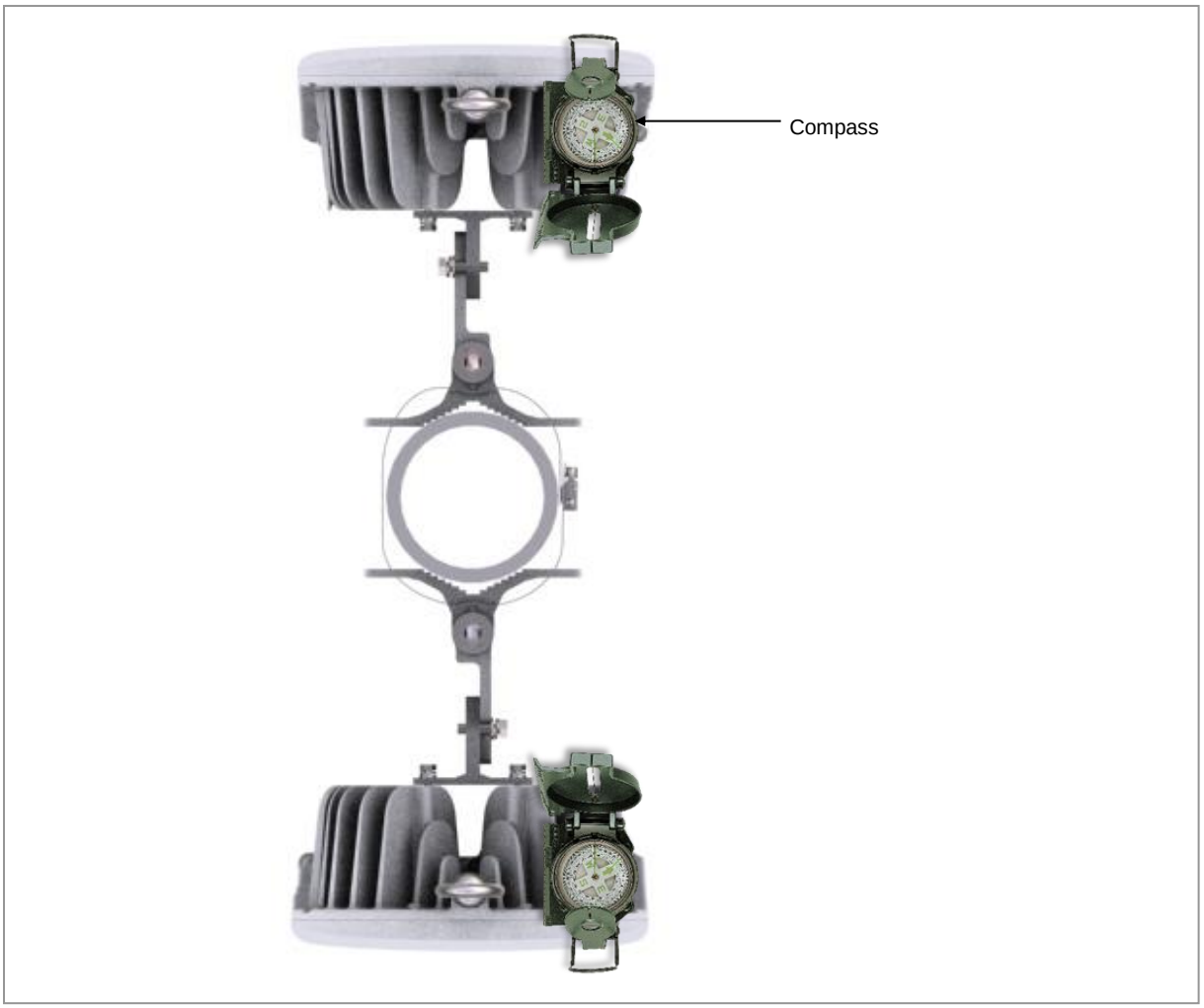
When installing the HRU, the tilting angle pointer of the unit bracket should point to 0°.



[Angle pointer position for unit bracket with 0° tilt when installing the HRU]

5 Use the compass to check the azimuth of the front view of the HRU.

Figure 37. Fixing HRUs on the Pole (5)



Fixing Wall Type

This section describes the procedures for fixing the system on the wall.

Fixing Mounting Bracket for 1 Sector

To fix the mounting bracket on the wall, do the following:

Prerequisites

Before proceeding with fixing the mounting bracket for 1-sector on the wall, make sure that you have the items mentioned in the table below:

Table 8. Tools for Marking

Category	Description
Working Tools	• Tape Measure • Permanent Maker • Level

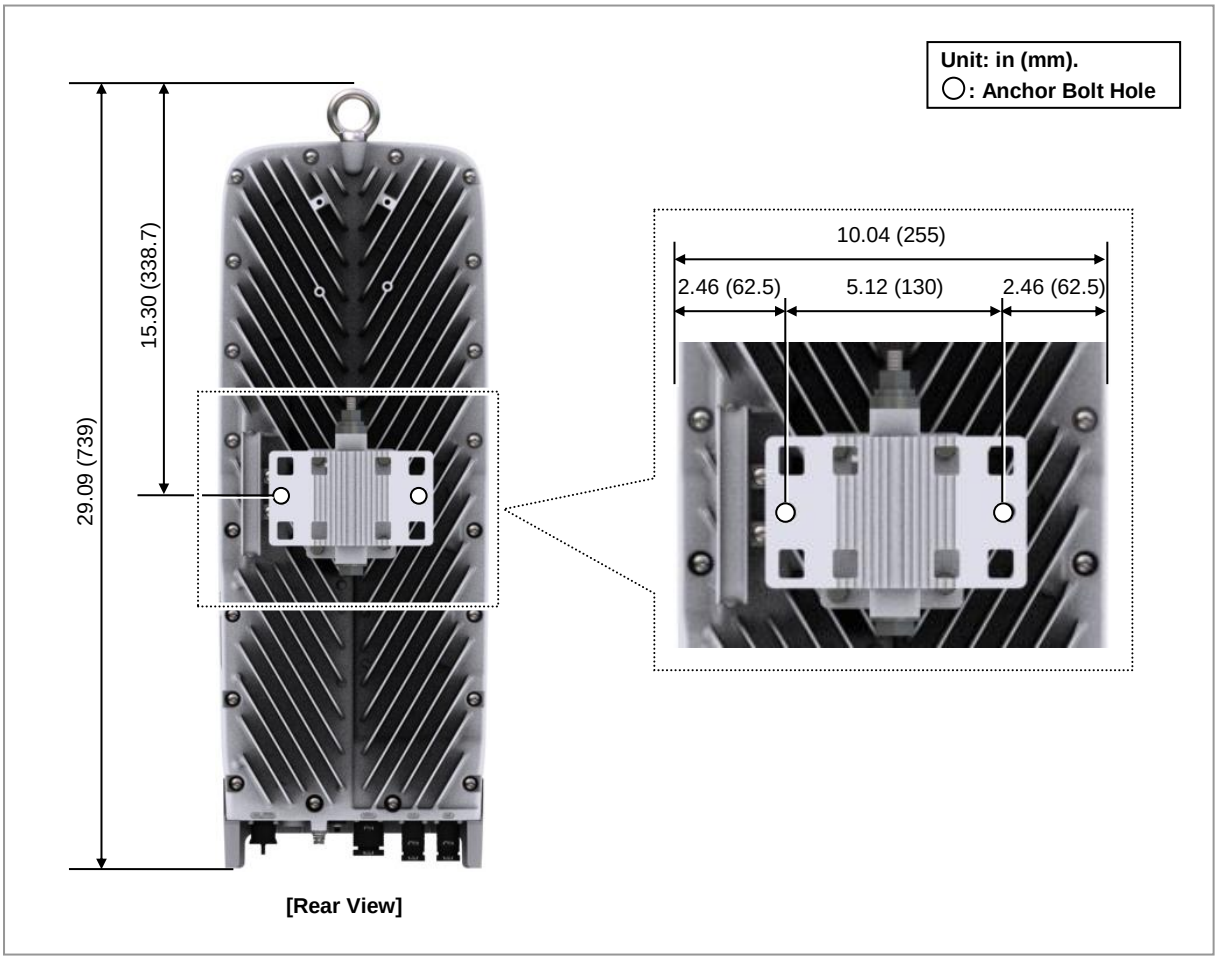
To mount the system on a wall, perform the leveling test by referring to the

System Leveling to check the positions are marked to be horizontal or vertical before drilling. If the result shows they are not horizontal or vertical, modify the marking positions.

When the position where the system will be placed is determined, place the system on that position and then mark the positions where anchor bolts will be fixed. This will reduce marking error range.

1 Check the distance between the location for fixing the HRU and the anchor bolt hole.

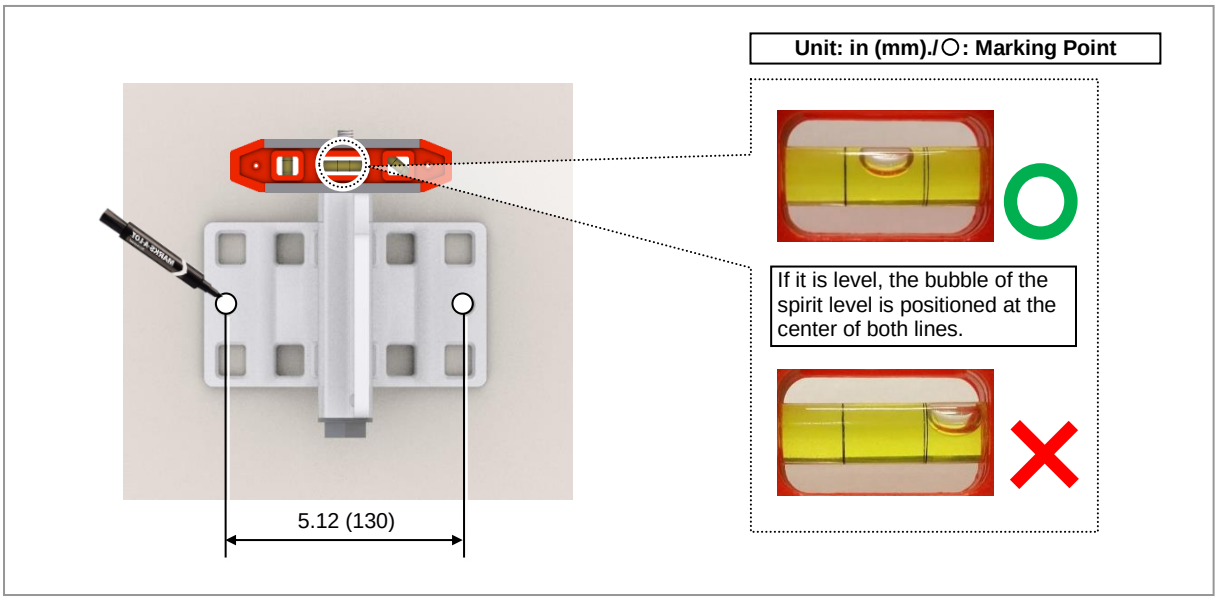
Figure 38. HRU Marking Dimensions



2 Place a mounting bracket on the fixing location, and then check the level status using a level and adjust the level of bracket assembly.

3 If the level status is normal, mark the anchor bolt holes on a wall.

Figure 39. Marking



To drill an anchor hole, do the following:

Prerequisites

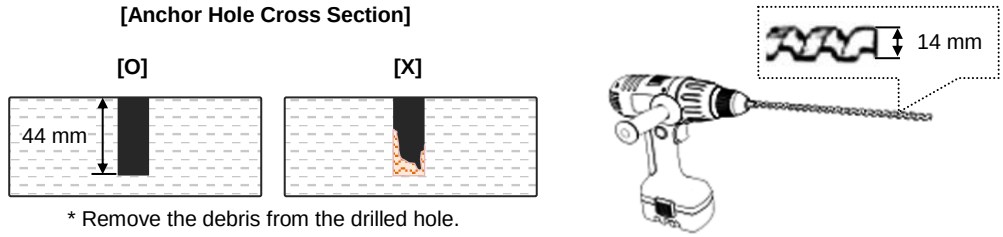
Before proceeding with the drilling process, make sure that you have items mentioned in the following table

Table 9. Parts and Tools for Drilling

Category	Description
Woking Tools	• Hammer Drill • Concrete Drill Bit (14 mm) • Vacuum Cleaner

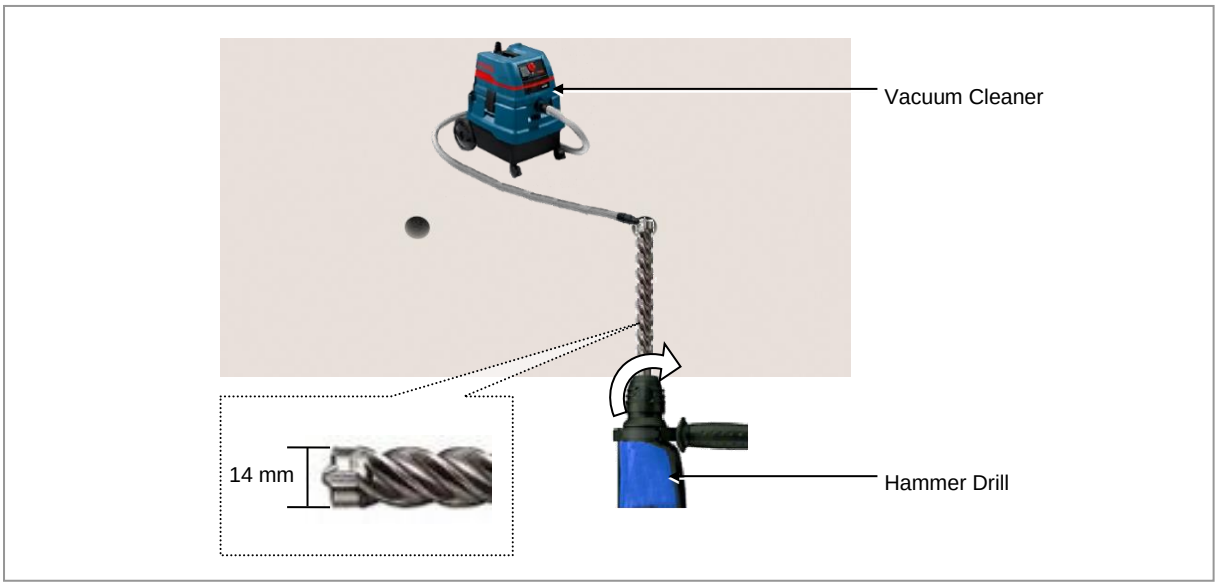
Table 10. Anchor Bolt Drill Bits and Hole Depth

Category	Anchor Bolt	Drill Bits	Hole Depth
HRU (Wall Type)	M10	14 mm	44 mm



4 Drill the anchor holes at the marked points.
Remove dust from the holes using a vacuum cleaner.

Figure 40. Drilling



Fixing Mounting Bracket on the Wall

To fix the mounting bracket on the wall, do the following:

Prerequisites

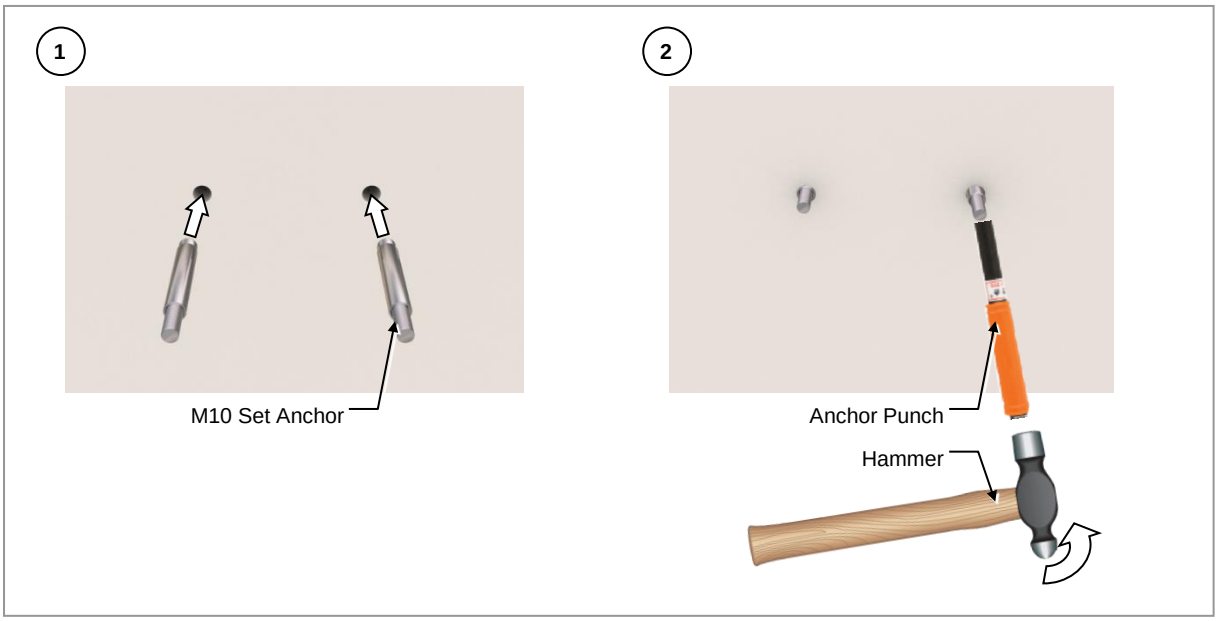
Before proceeding with fixing the mounting bracket for 1-sector on the wall, ensure that you have the items mentioned in the table below:

Table 11. Parts and Tools for Fixing Mounting Bracket on the Wall

Category	Description		
Parts	Mounting Bracket		1 EA
	Fasteners	M10 Set Anchor Assembly • M10 Set Anchor • M10 Plain Washer • M10 Spring Washer • M10 Hex. Nut	2 Set 1 EA/set 1 EA/set 1 EA/set 1 EA/set
Recommended Torque Value	M10 Hex. Nut		217 lbf·in (250 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner head (apply hexagonal. head: 17 mm) • Spanner (17 mm) • Hammer • Anchor Punch (for M10 set anchor bolt)		

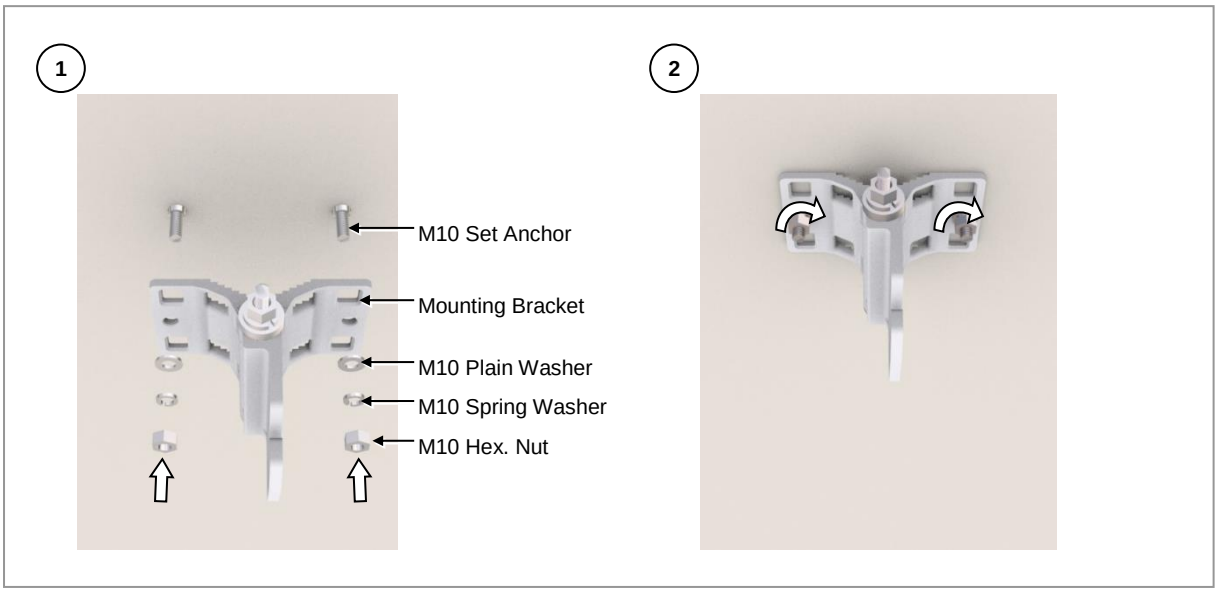
1 Fix the anchor to the drilled hole.

Figure 41. Fixing Mounting Bracket on the Wall (1)



2 Place the mounting bracket on the wall and fix it using fasteners.

Figure 42. Fixing Mounting Bracket on the Wall (2)



Fixing HRU on the Wall

To fix the HRU on the wall, do the following:

Prerequisites

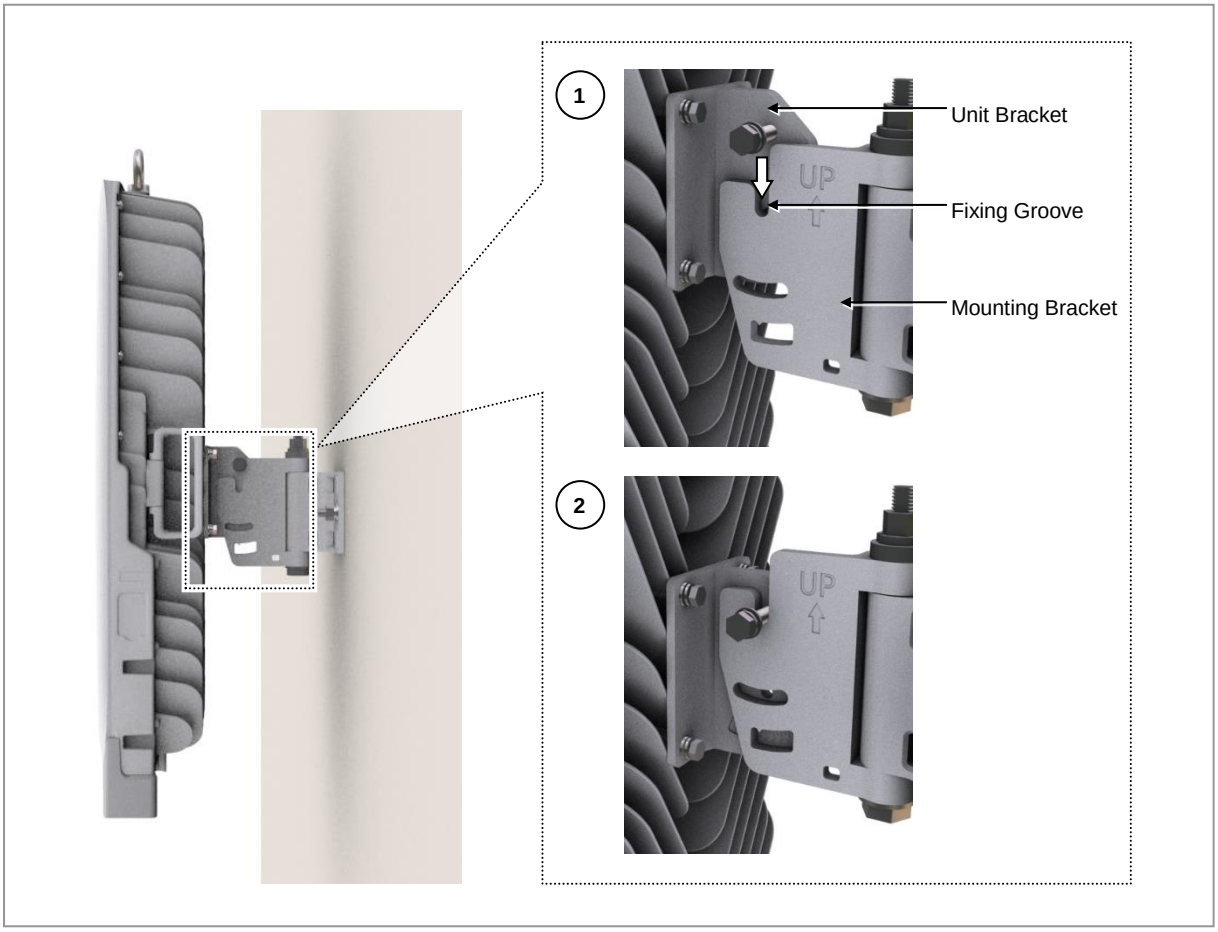
Before proceeding with fixing the HRU on the wall, ensure that you have the items mentioned in the table below:

Table 12. Parts and Tools for Fixing HRU on the Wall

Category	Description	
Fasteners	M8 × L30 hexagonal bolt (Washer assembly)	1 EA
Recommended Torque Value	M8 hexagonal bolt	110 lbf·in (127 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagonal head: 13 mm)	

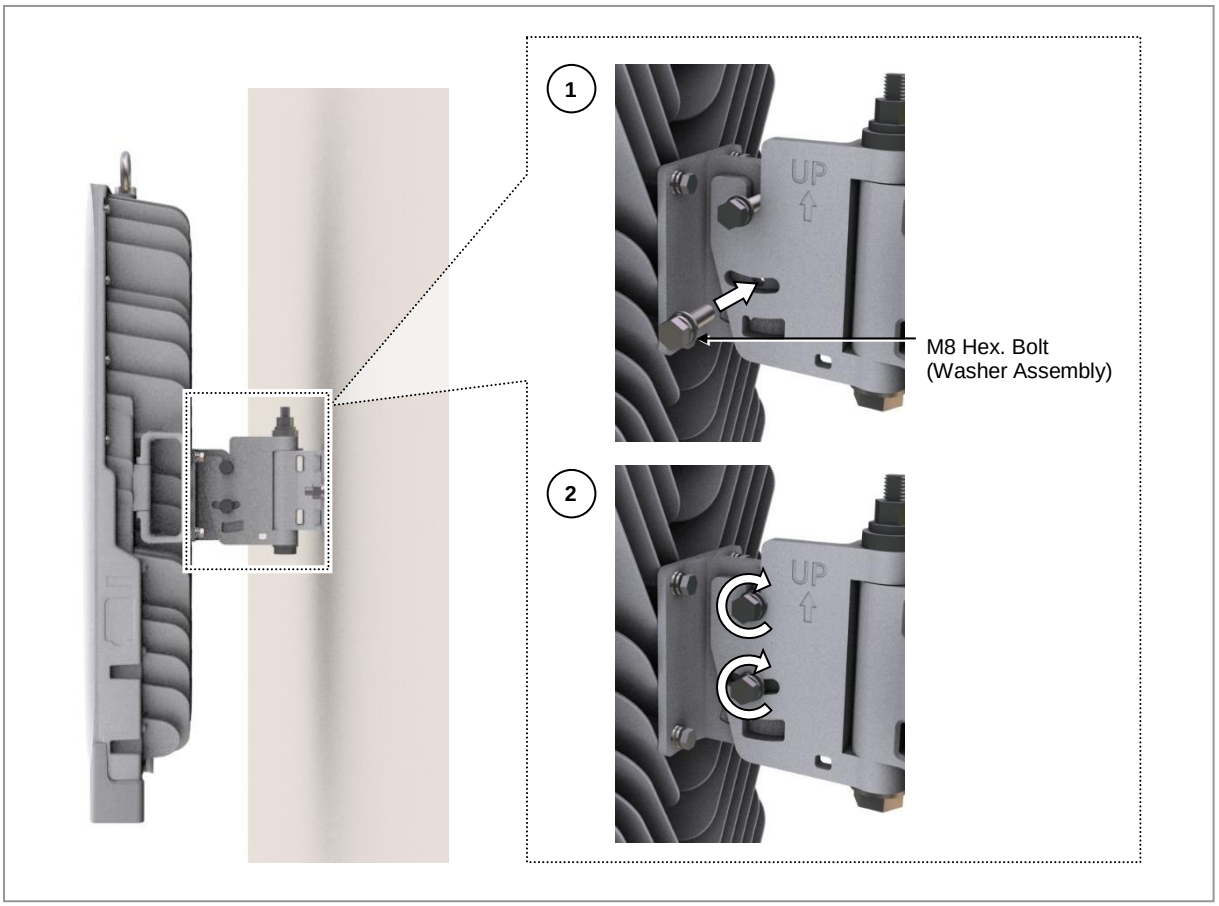
1 Place the unit bracket on the fixing groove of the mounting bracket.

Figure 43. Fixing HRU on the Wall (1)



2 Fix the HRU using the fasters.

Figure 44. Fixing HRU on the Wall (2)



Tilting

The instructions for tilting the HRU apply to all installation types.

The adjustable tilting range is as follows:
- Up tilting: 0° to 16°
- Down tilting: 0° to 16°

To adjust the HRU tilting, do the following:

Prerequisites

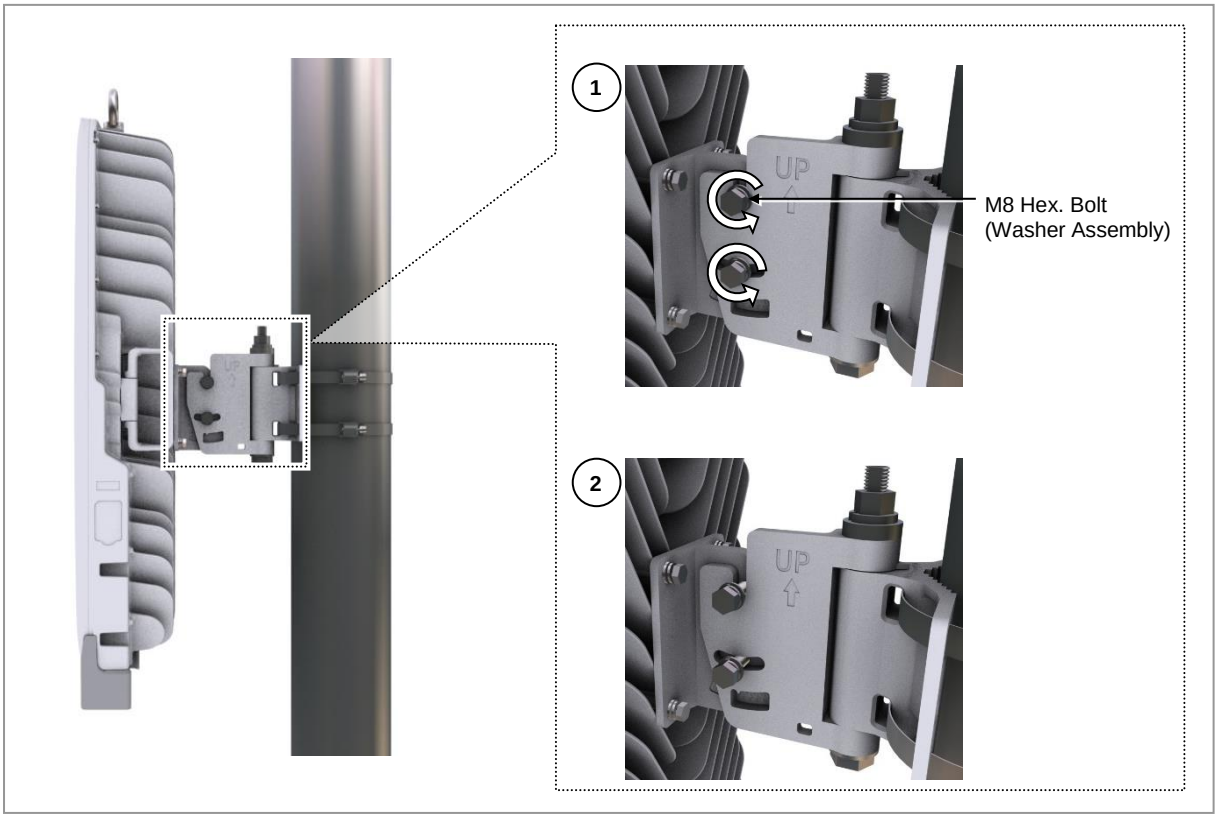
Before proceeding with adjusting the HRU tilting, make sure that you have the items mentioned in the table below:

Table 13. Tools for Tilting HRU

Category	Description	
Recommended Torque Value	M8 hexagonal bolt	110 lbf·in (127 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagonal head: 13 mm) • Spanner (13 mm)	

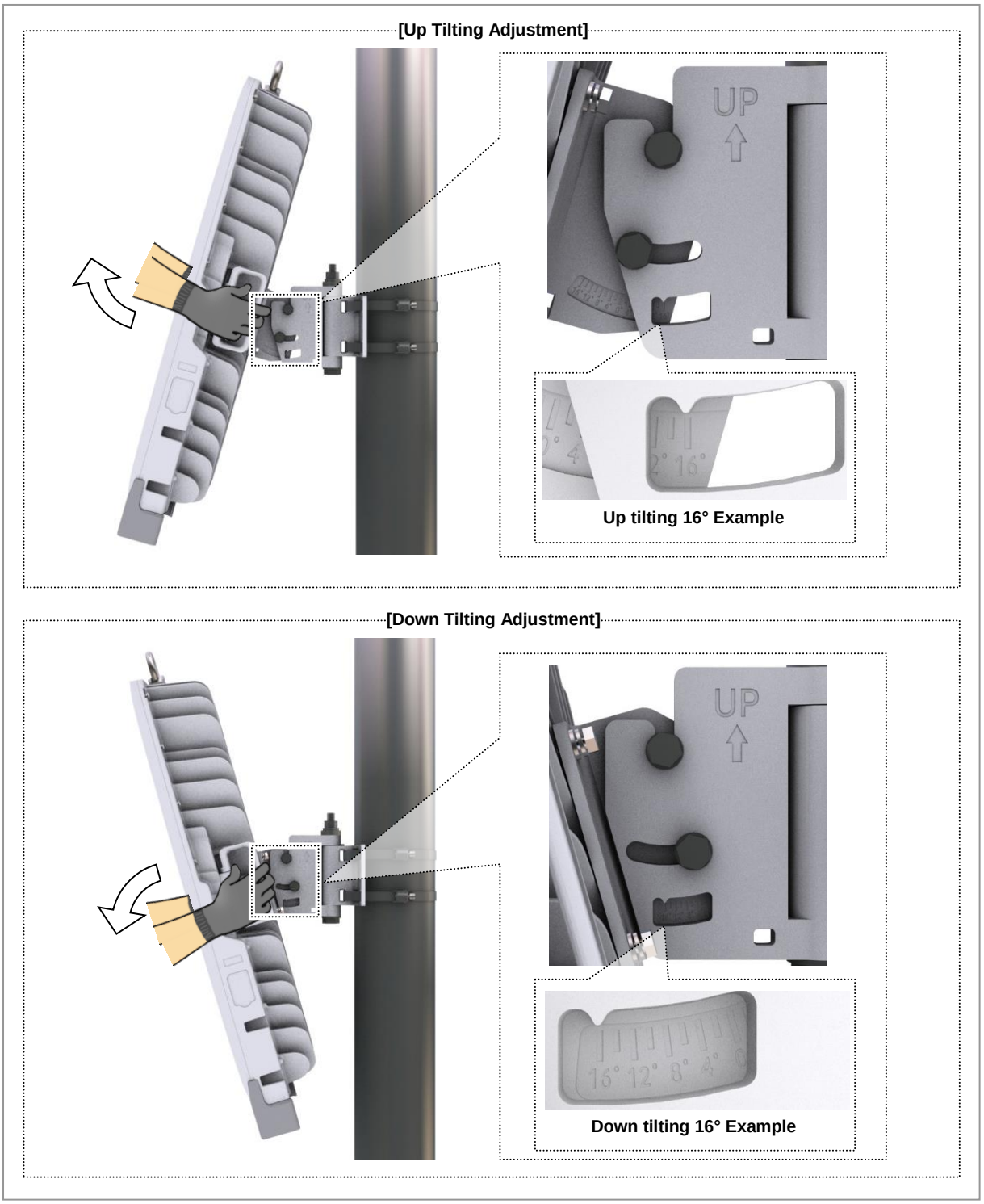
1 Loosen the HRU by turning M8 hexagonal bolt of mounting bracket two or three times counterclockwise.
Do not separate it completely.

Figure 45. HRU Tilting Adjustment (1)



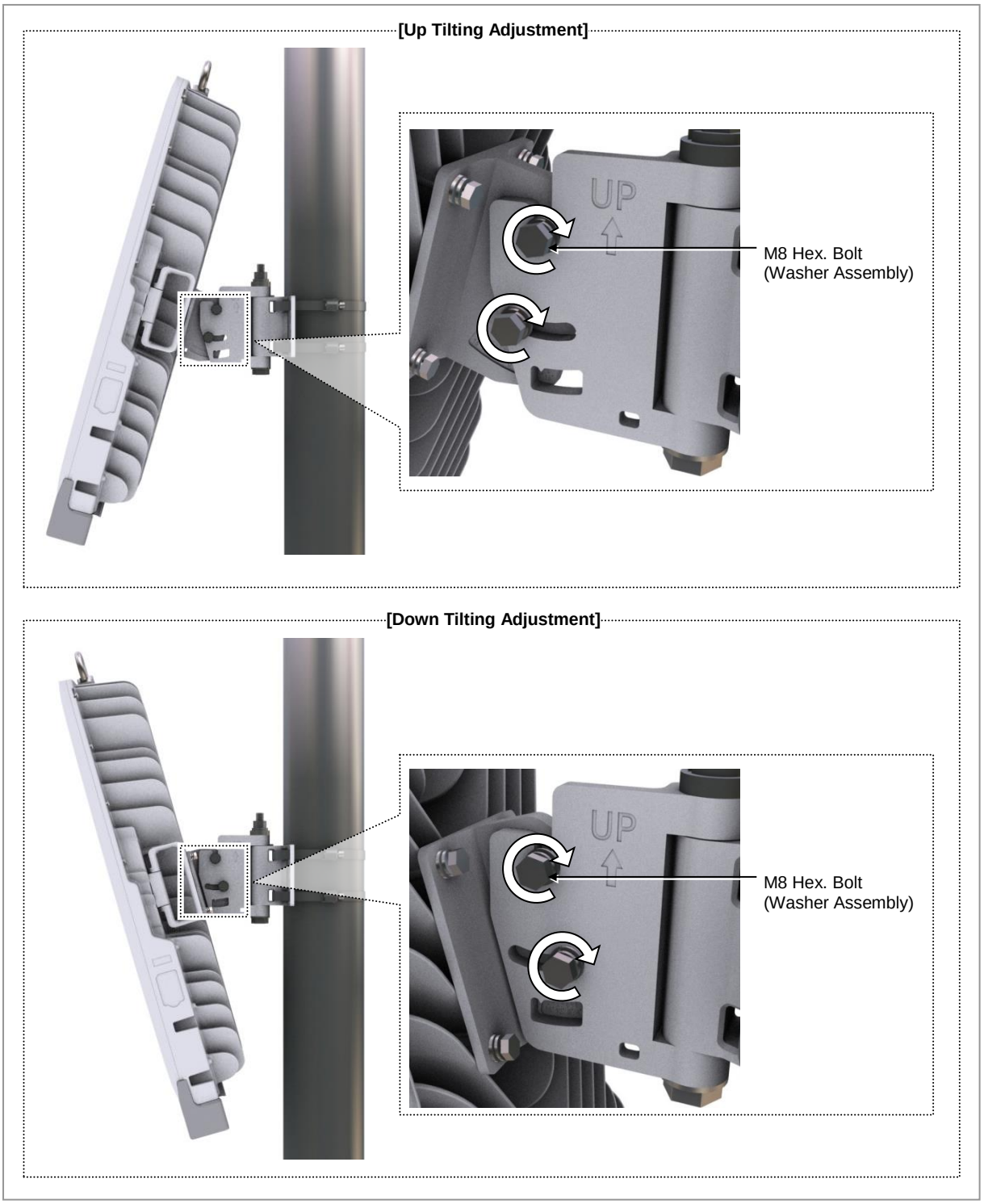
2 Pull the HRU up/down to adjust the tilting angle.

Figure 46. HRU Tilting Adjustment (2)



3 Fix the HRU using the working tools.

Figure 47. HRU Tilting Adjustment (3)



Swiveling

The instructions for swiveling the HRU apply to all installation types.

The adjustable swiveling is as follows:
- Left Swiveling: 0° to 30°
- Right Swiveling: 0° to 30°

To adjust the HRU swivelling, do the following

Prerequisites

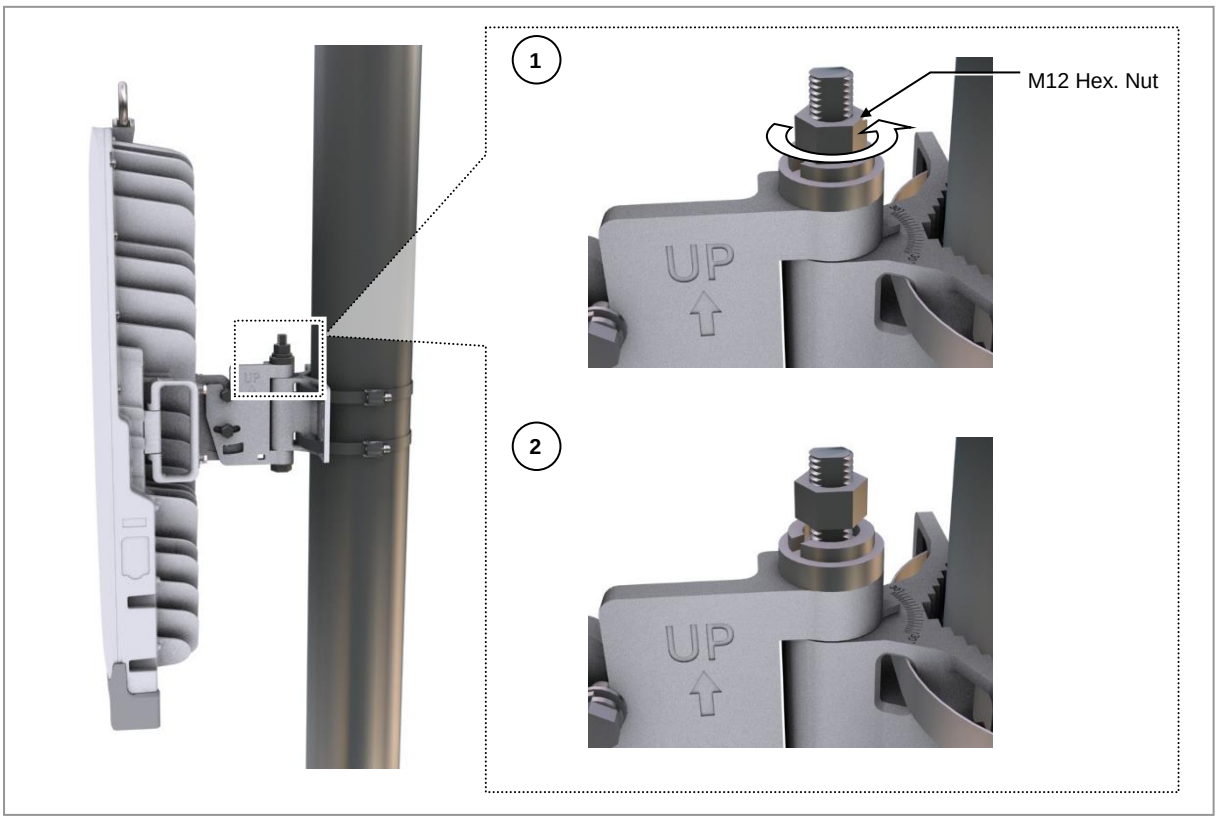
Before proceeding with swiveling the HRU, make sure that you have the items mentioned in the table below:

Table 14. Tools for Swiveling HRU

Category	Description	
Recommended Torque Value	M12 hexagonal nut	372 lbf·in (428 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagonal head: 19 mm) • Spanner (19 mm)	

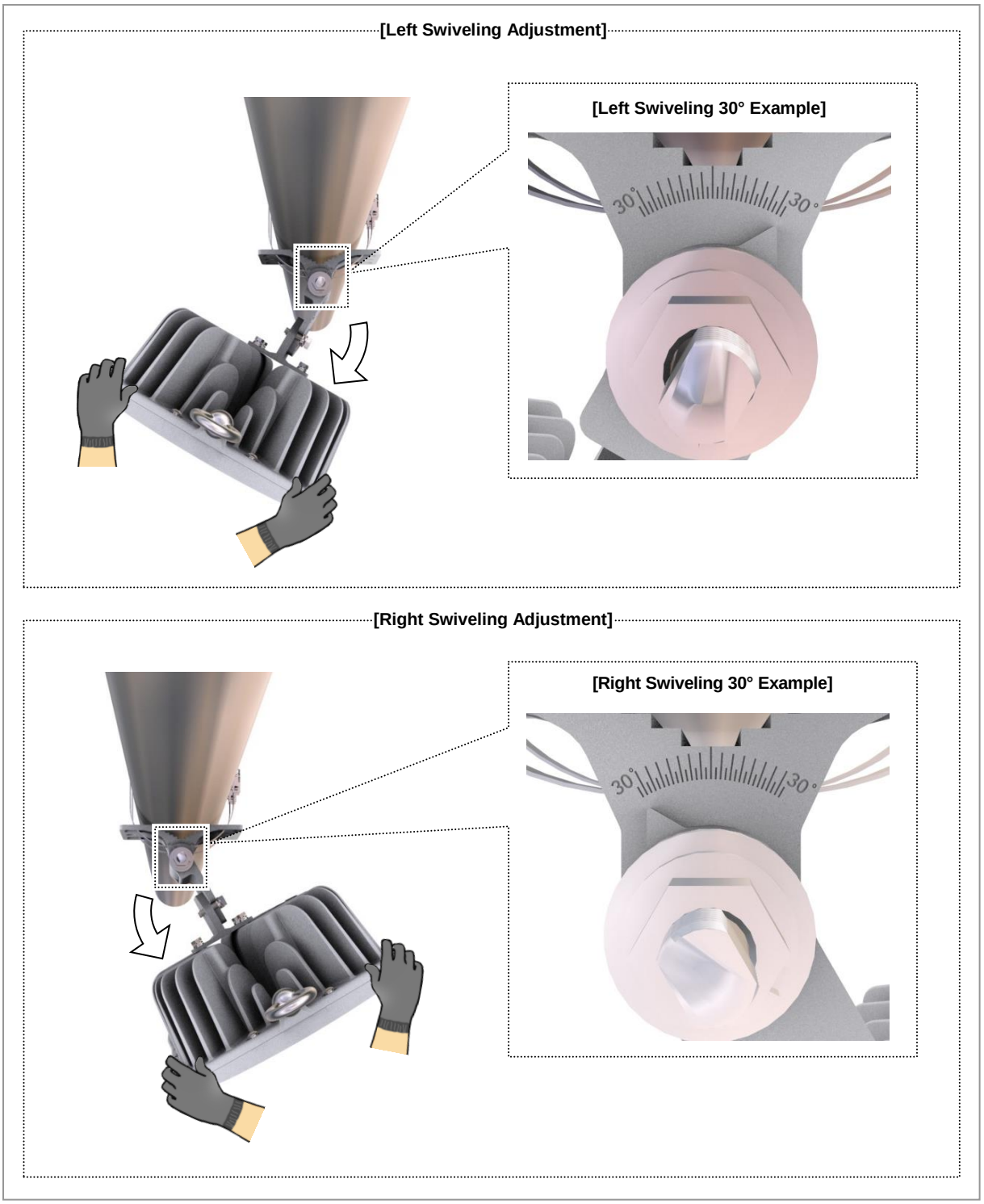
1 Loosen the HRU by turning M12 hexagonal nut of mounting bracket two or three times counter clockwise.
Do not separate it completely.

Figure 48. HRU Swiveling Adjustment (1)



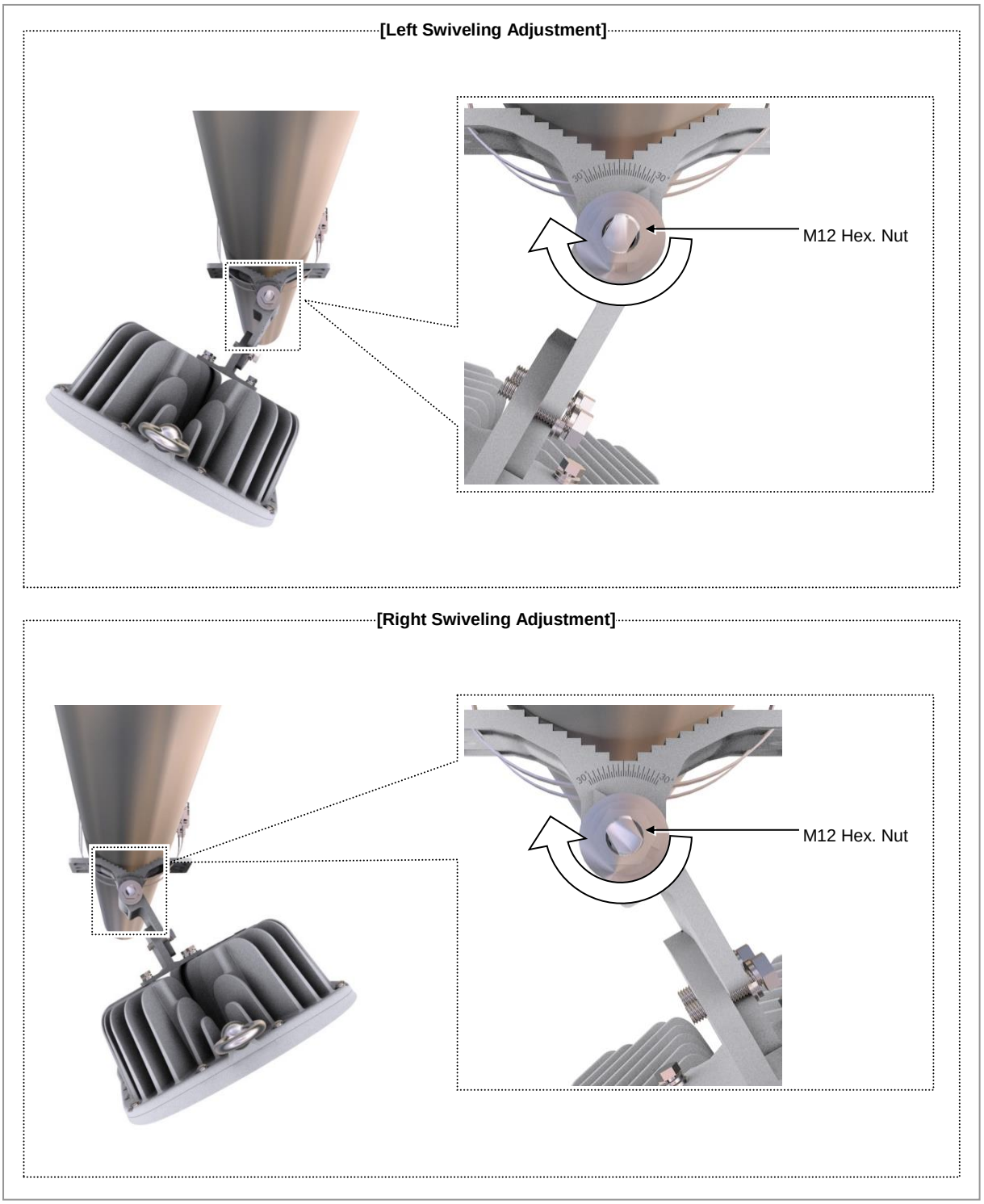
2 Pull the HRU left/right to adjust the swiveling angle.

Figure 49. HRU Swiveling Adjustment (2)



3 Fix the HRU using working tools.

Figure 50. HRU Swiveling Adjustment (3)



Without the Tilting Bracket

This section describes the procedures to fix the unit bracket and the mounting bracket.

Fixing Unit Bracket

The instructions for mounting a unit bracket to the HRU apply to all installation types.

To fix the unit bracket without tilting bracket, do the following:

Prerequisites

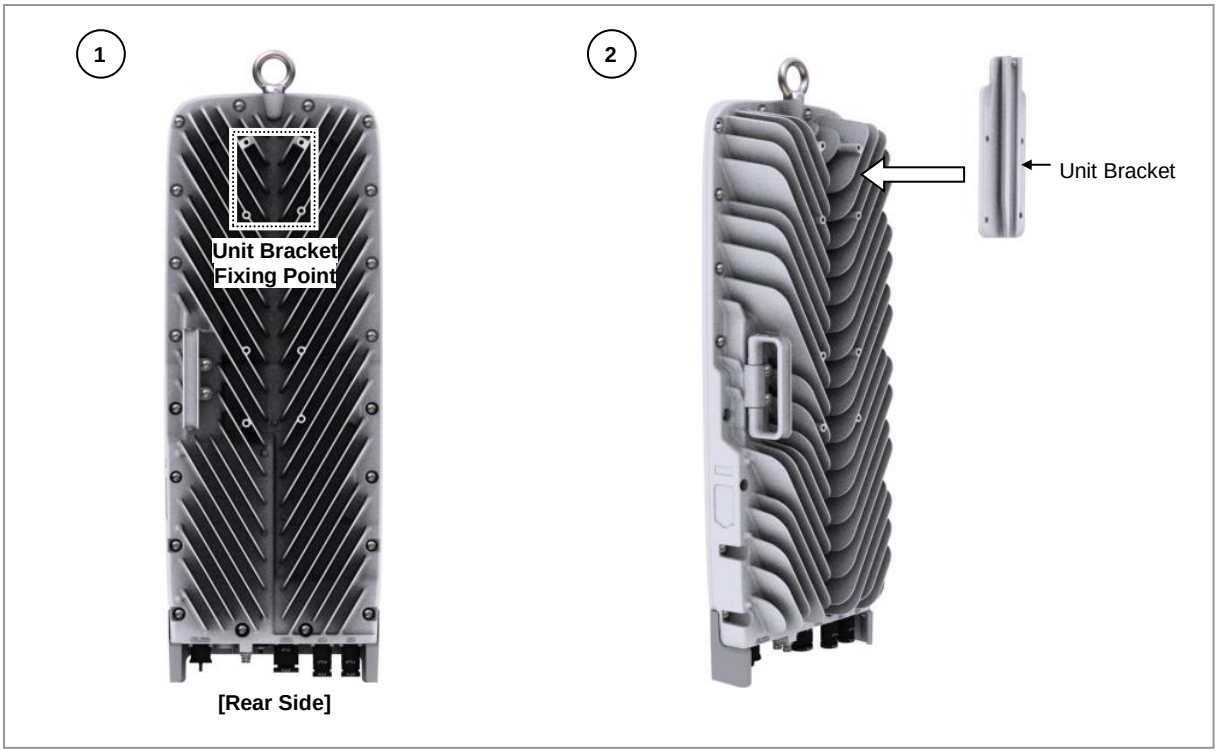
Before proceeding with fixing the unit bracket on the HRU, make sure that you have the items mentioned in the table below:

Table 15. Parts and Tools for Fixing Unit Bracket on HRU

Category	Description		
Parts	Unit Bracket		1 EA/HRU
	Fasteners	M6 × L20 hexagonal bolt (Washer assembly)	4 EA/HRU
Recommended Torque Value	M6 hexagonal bolt		43 lbf·in (50 kgf·cm)
Working Tools	• Torque Wrench (10 to 50 lbf·in) • Torque Wrench Spanner Head (apply hexagon head: 10 mm)		

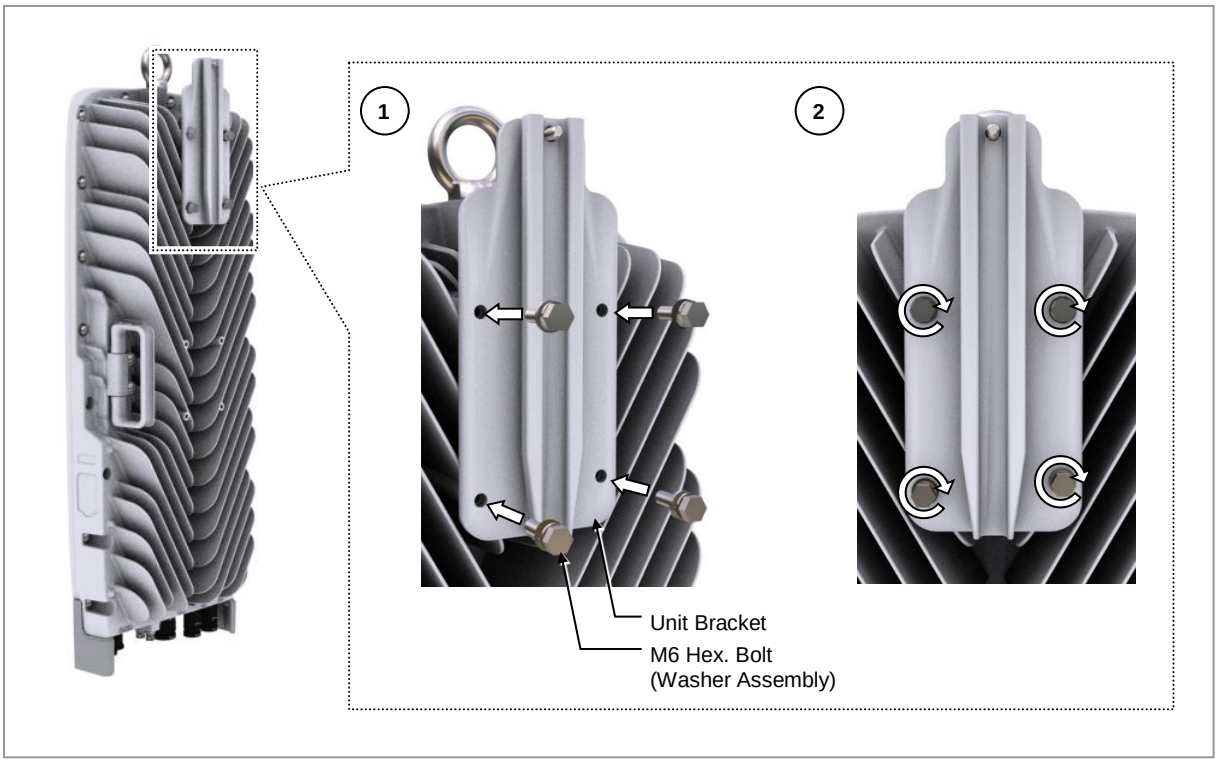
1 Check the position for mounting the unit bracket on the back of the HRU and place it in that position.

Figure 51. Fixing Unit Bracket (1)



2 Fix the unit bracket using the fasteners.

Figure 52. Fixing Unit Bracket (2)



Fixing Pole Type

The standard of the pole on which the mounting bracket can be attached using steel bands is 50 A to 150 A.(250 A is optional)

Fixing Mounting Bracket for 1 sector

To fix the mounting bracket on the pole, do the following:

Prerequisites

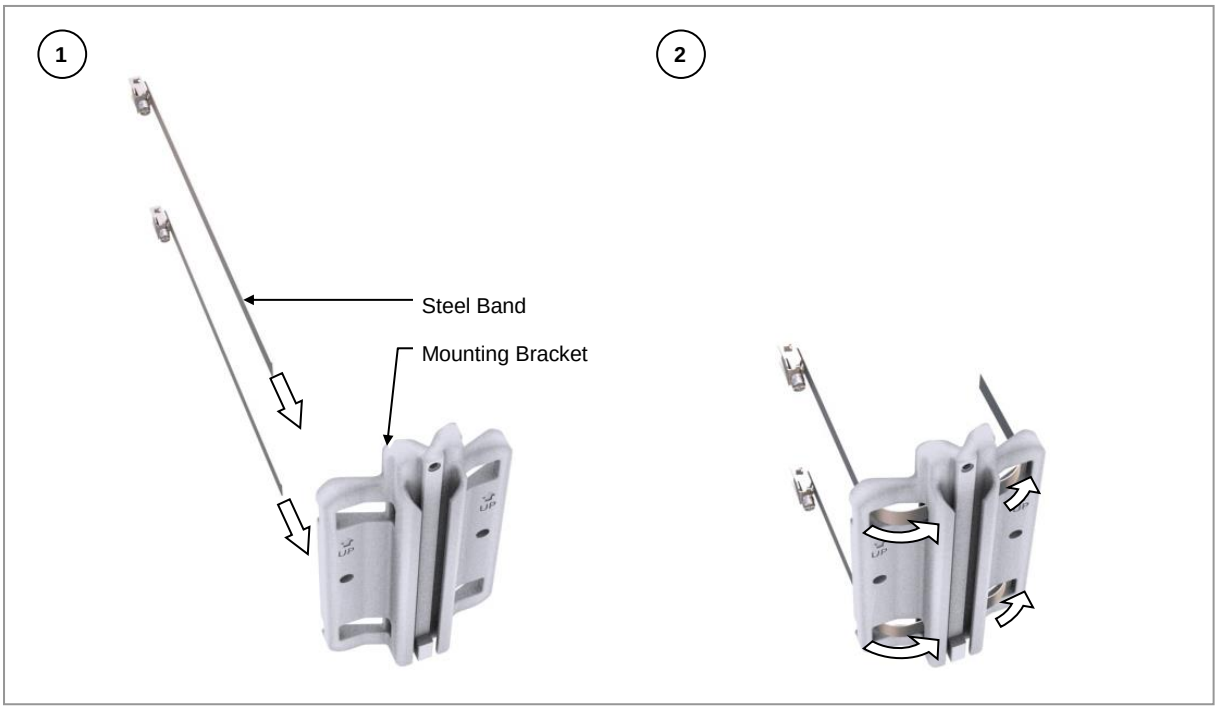
Before proceeding with fixing the mounting bracket for 1-sector wall type, make sure that you have the items mentioned in the table below:

Table 16. Parts and Tools for Fixing Mounting Bracket on the Pole

Category	Description		
Parts	Mounting Bracket		1 EA
	Fasteners	Steel Band	2 EA
Recommended Torque Value	Steel Band Fixing Screw		48.5 lbf·in (56.1 kgf·cm)
Working Tools	• Torque Driver (20 to 90 lbf·in) • Screw Driver Bit ('+', No. 3) • Compass		

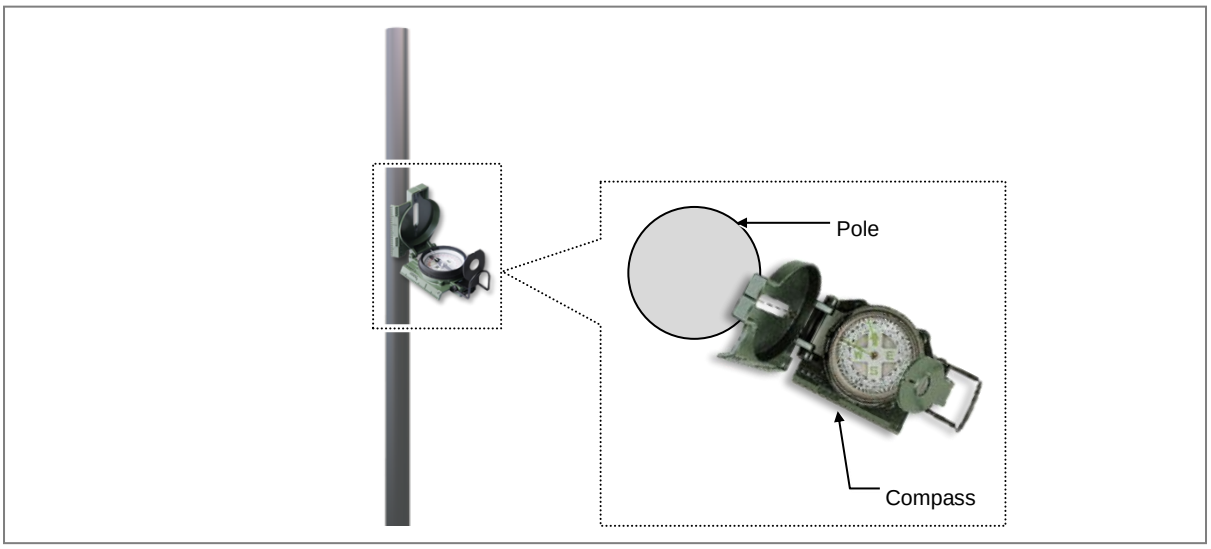
1 Pass the steel band through the fixing hole of the mounting bracket.

Figure 53. Fixing Mounting Bracket on the Pole (1)



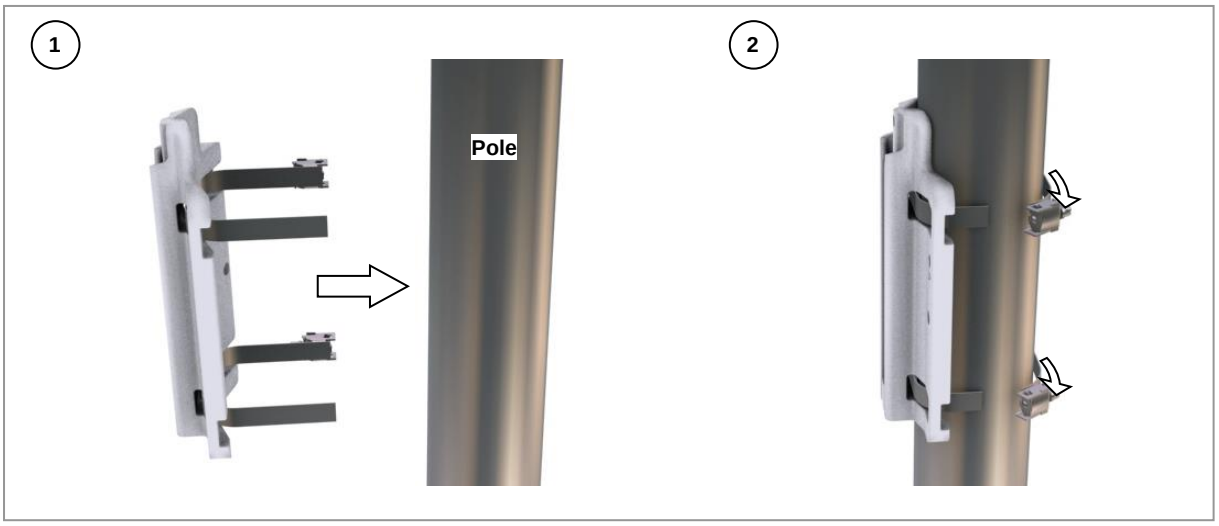
2 Use the compass to determine the azimuth of the HRU to be installed on the pole.

Figure 54. Fixing Mounting Bracket on the Pole (2)



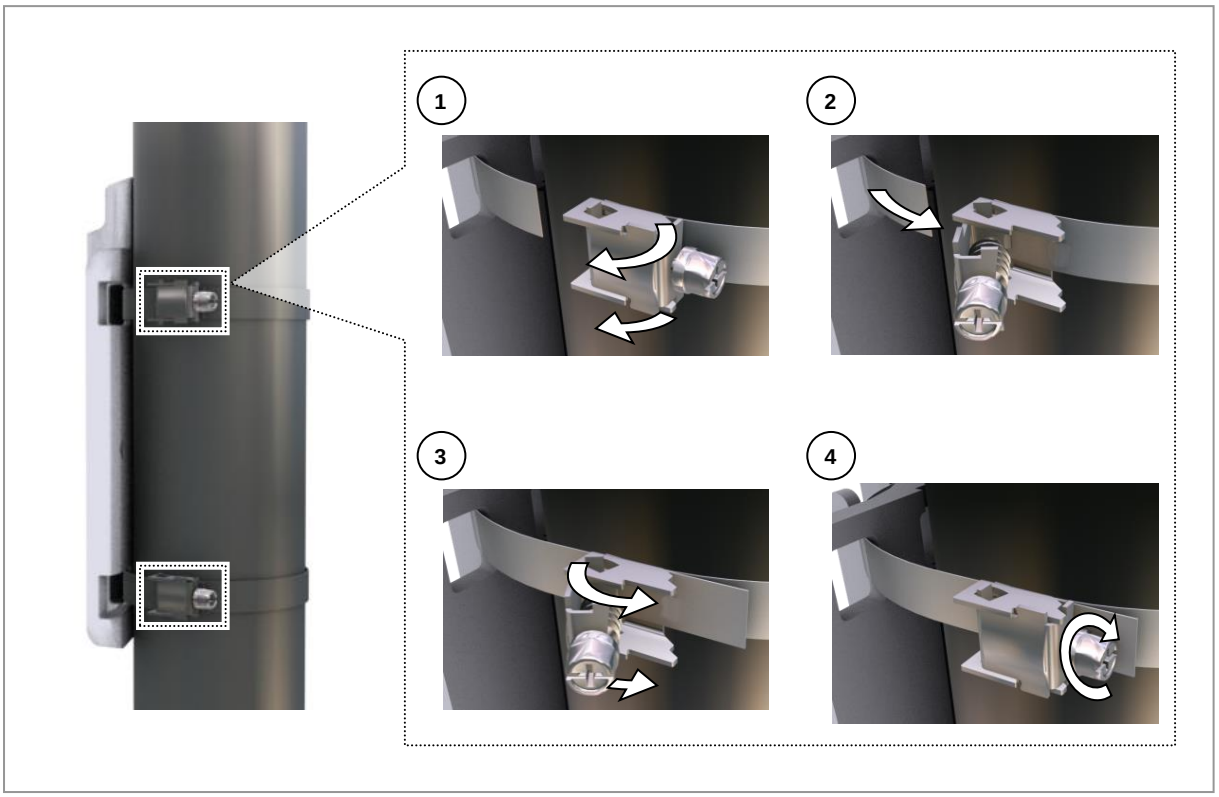
3 Place the mounting bracket to the pole.

Figure 55. Fixing Mounting Bracket on the Pole (3)



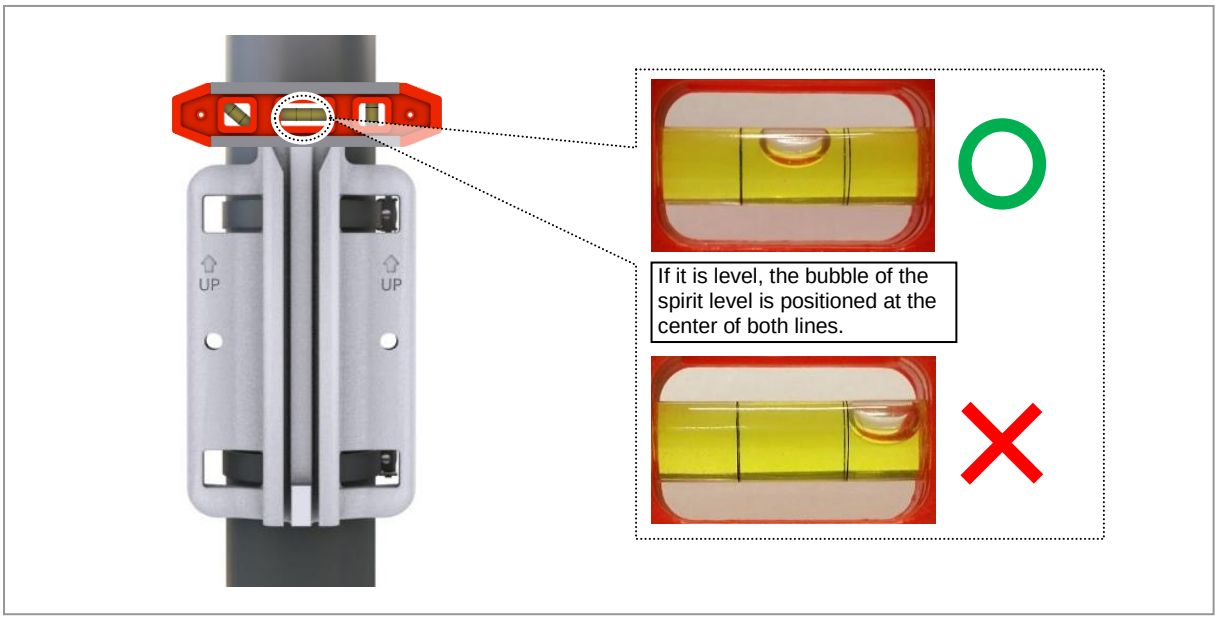
4 Fix the mounting bracket to the pole using the steel band.

Figure 56. Fixing Mounting Bracket on the Pole (4)



5 Check the level of mounting bracket on the pole and adjust the level.

Figure 57. Fixing Mounting Bracket on the Pole (5)



When fixing the mounting bracket on the pole, be sure to check the level of bracket. After finishing the installation, adjust the level minutely.

When poor leveling happens, adjust the position of fasteners used to fix the mounting bracket.

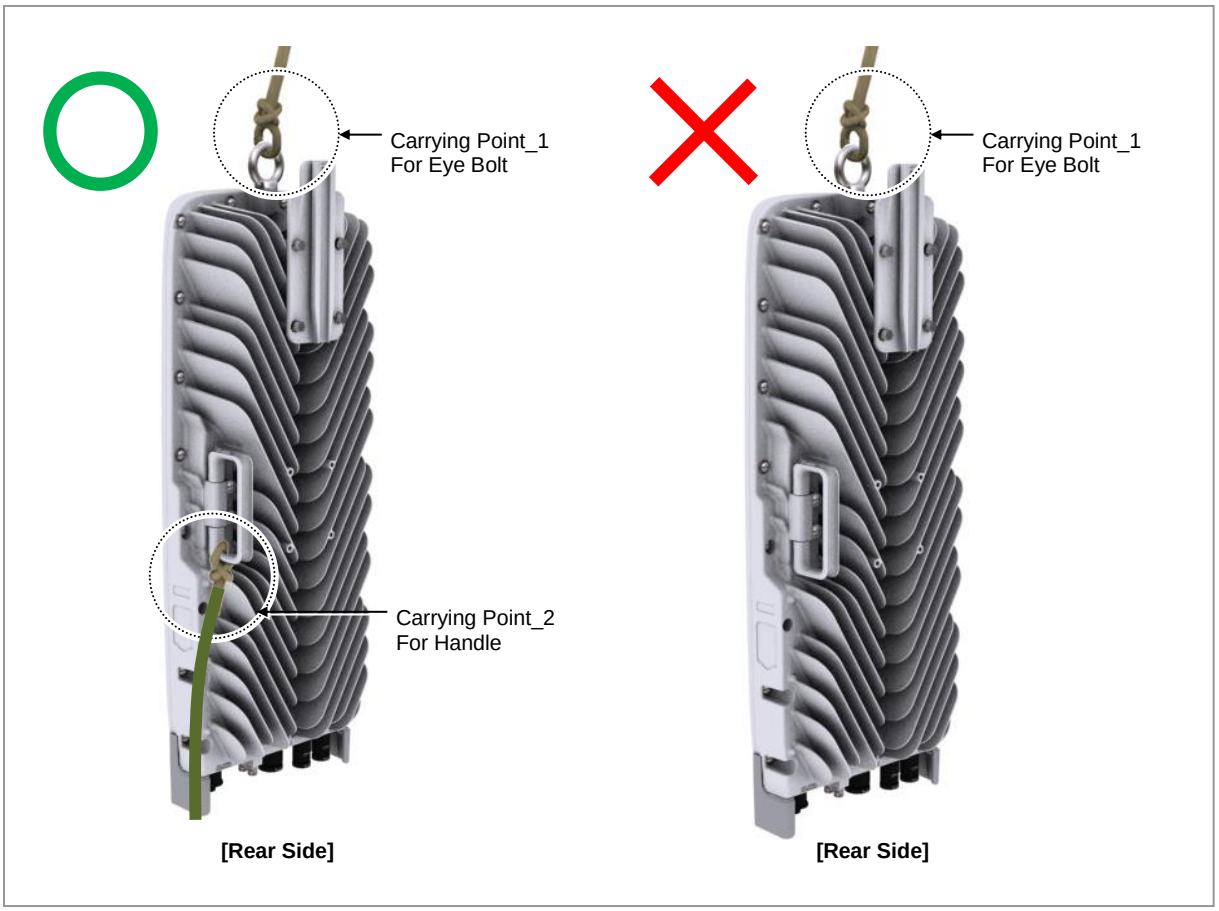
After fixing the steel band, push the remainder of band inside the mounting bracket

Lifting HRU

To lift the HRU, do the following:

1 Tie the rope in two carrying points of the HRU.

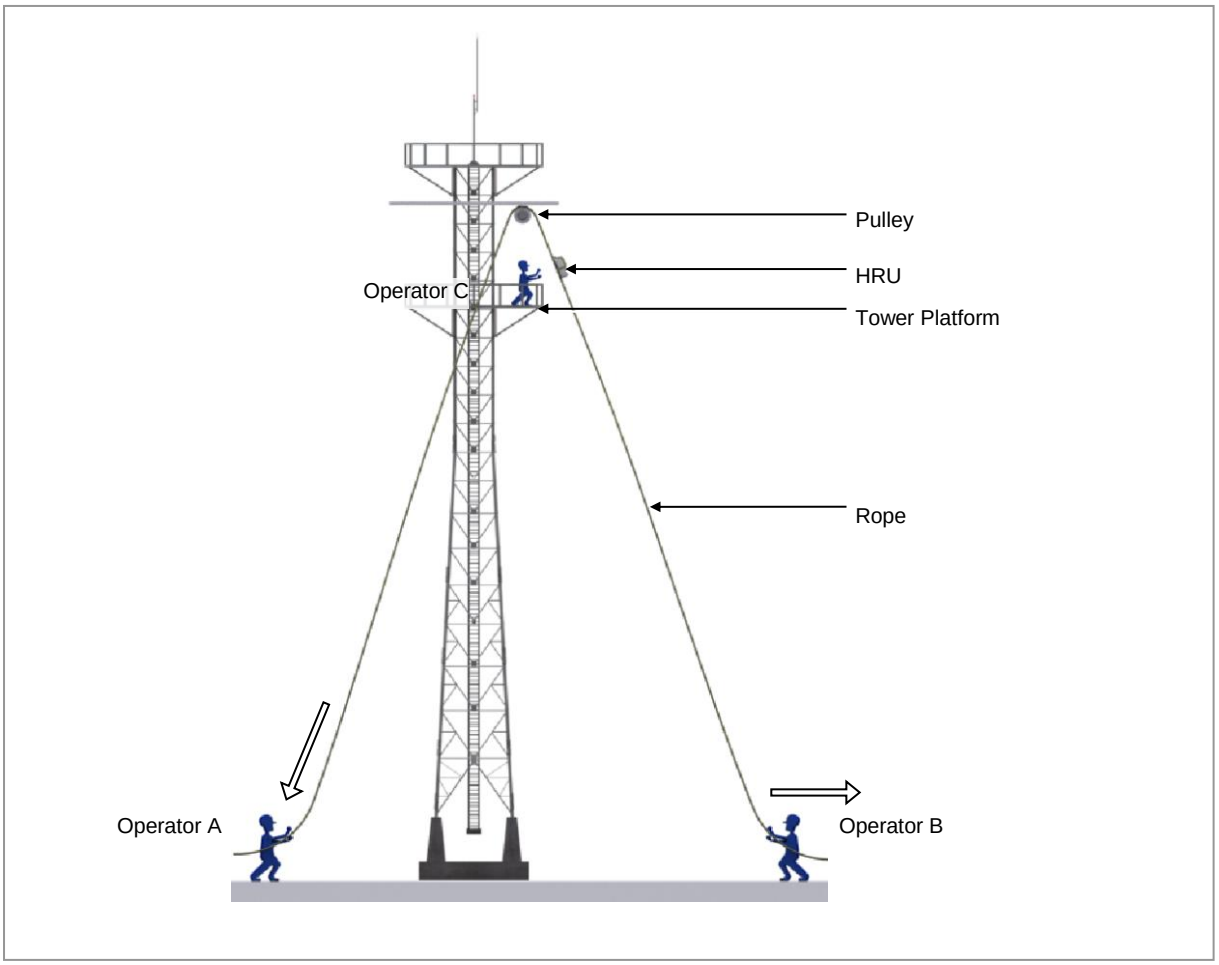
Figure 58. Lifting HRU (1)



2 While Operator A hauls the rope to carry up the HRU, Operator B pulls the rope outward, so that the HRU would not hit the tower platform.

3 Operator C locates the carried HRU to the installation position.

Figure 59. Lifting HRU (2)



Fixing HRU on the Pole

To fix the HRU on the pole, do the following:

Prerequisites

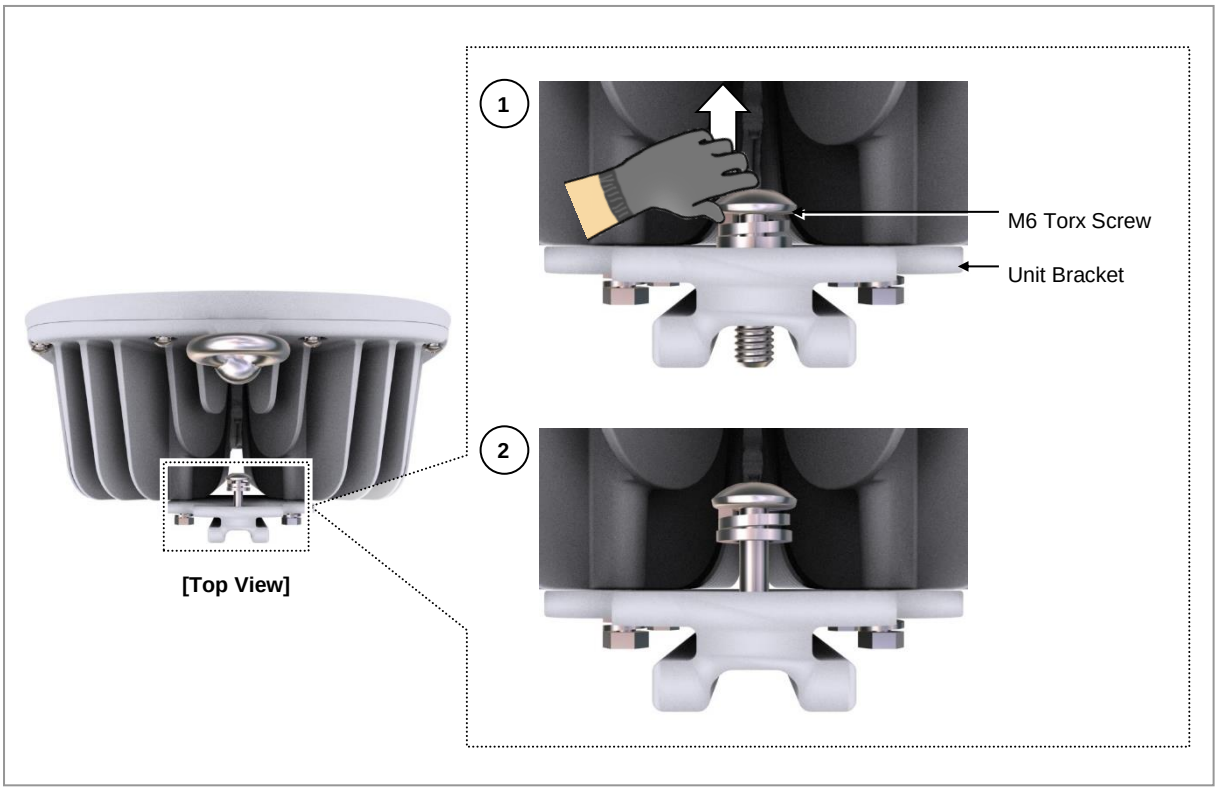
Before proceeding with fixing the HRU on the pole, make sure that you have the items mentioned in the table below:

Table 17. Tools for Fixing HRU on the Pole

Category	Description	
Recommended Torque Value	M6 Torx Screw	43 lbf·in (50 kgf·cm)
Working Tools	• Torx Driver Bit (T30H) • Torque Driver (20 to 90 lbf·in) • Compass	

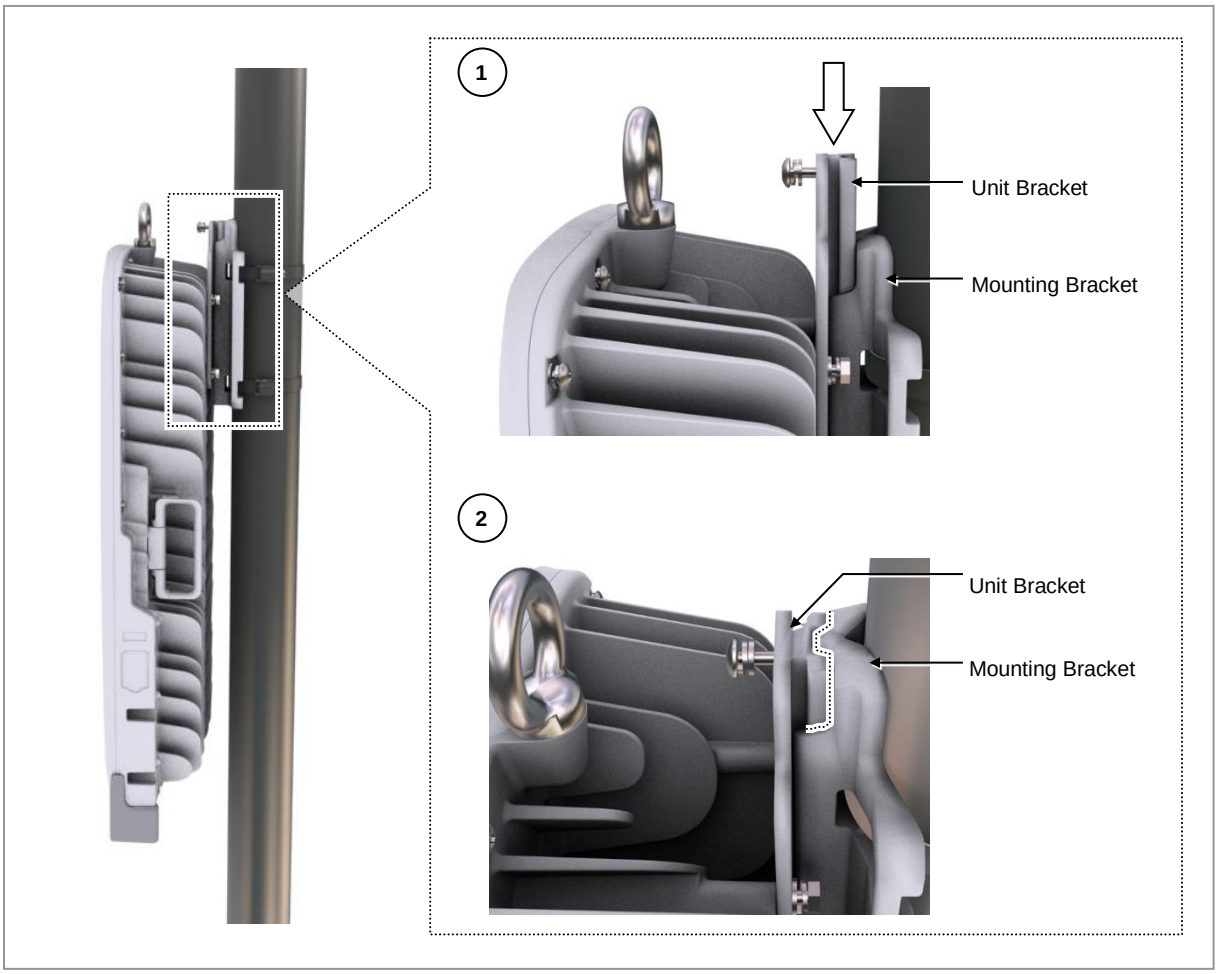
1 Pull out the fastening materials so that they do not get out from the fixing groove of the unit bracket.
Do not pull out completely.

Figure 60. Fixing HRU on the Pole (1)



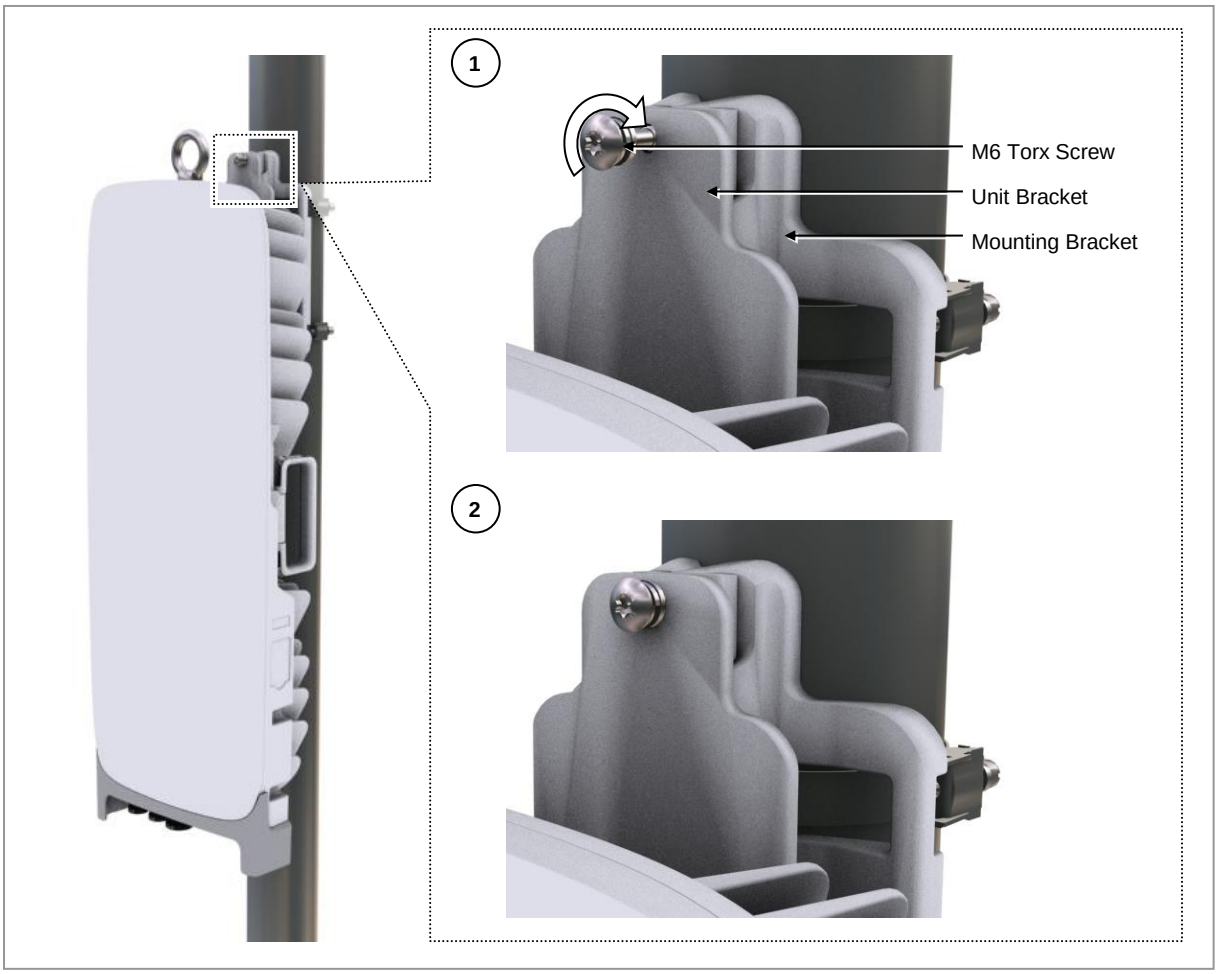
2 Place the unit bracket on the fixing grooves of the mounting bracket and push the unit bracket down to fix the HRU in place.

***Figure 61.** Fixing HRU on the Pole (2)*



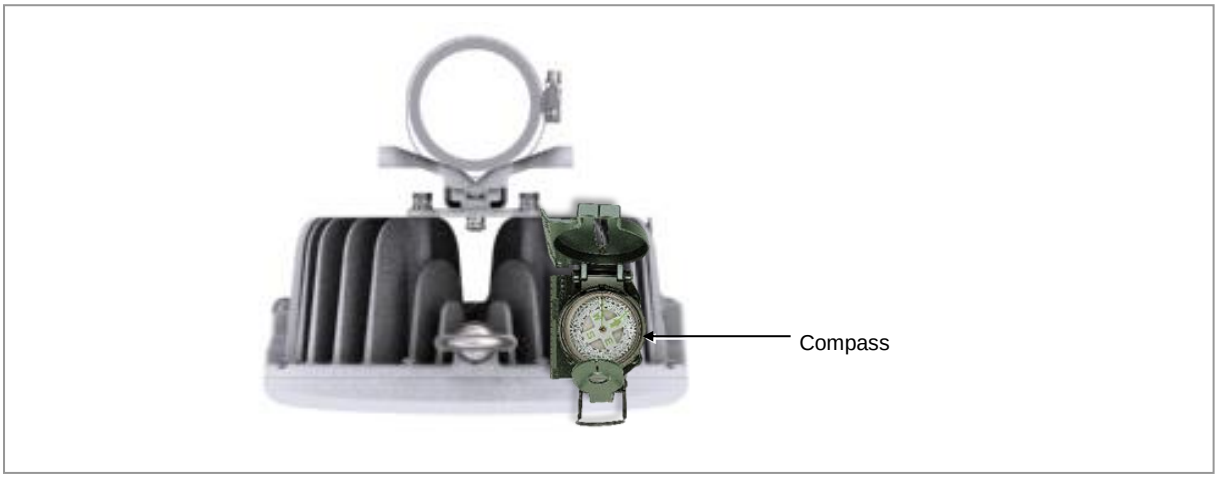
3 Fix the unit bracket to the mounting bracket using the fastener.

Figure 62. Fixing HRU on the Pole (3)



4 Use the compass to check the azimuth of the front of the HRU.

Figure 63. Fixing HRU on the Pole (4)



Fixing Mounting Bracket for 2 Sector

To fix the mounting bracket on the pole, do the following:

Prerequisites

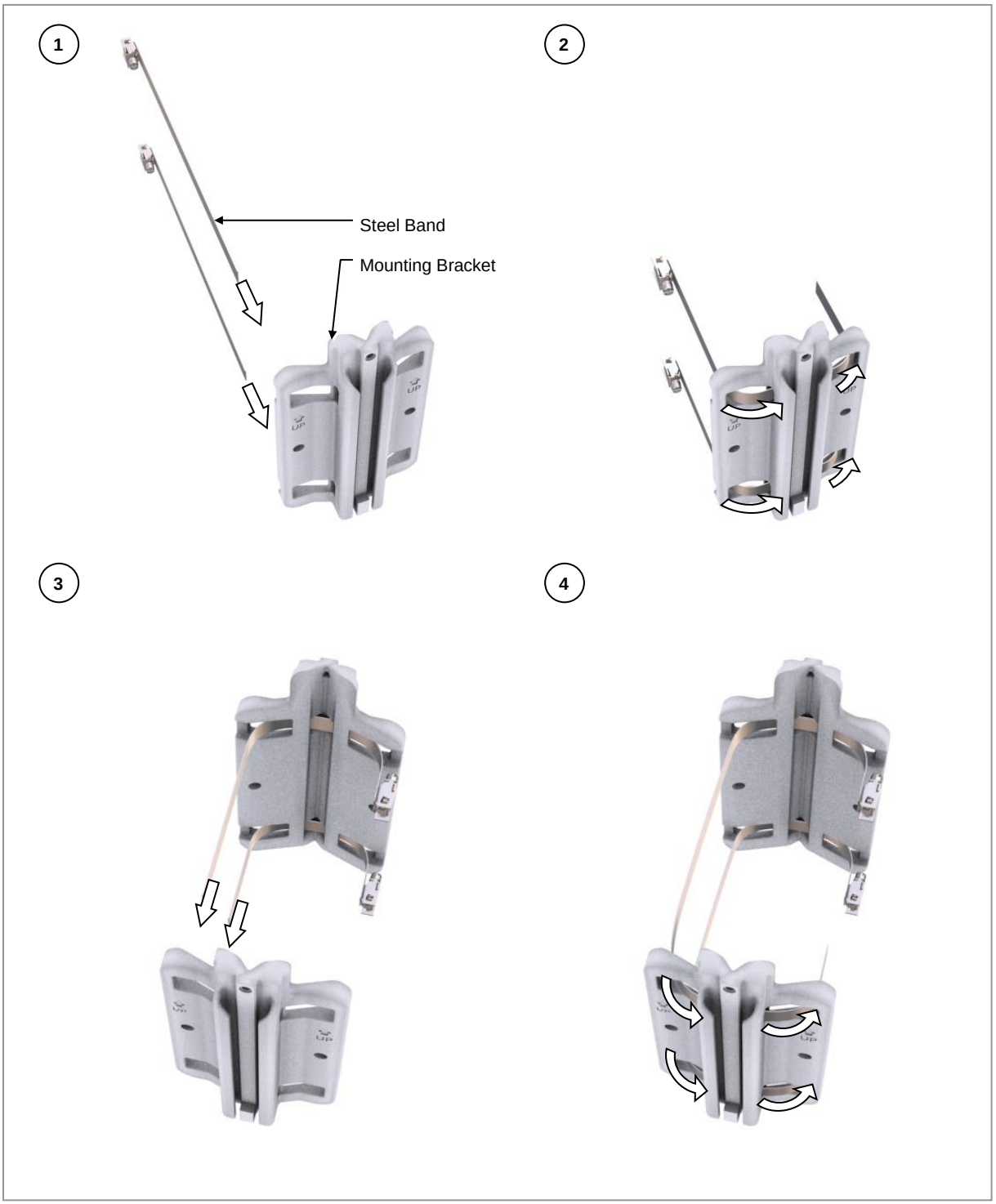
Before proceeding with fixing the mounting bracket 2 sector pole type, make sure that you have the items mentioned in the table below:

Table 18. Parts and Tools for Fixing Mounting Bracket on the Pole

Category	Description		
Parts	Mounting Bracket		2 EA
	Fasteners	Steel Band	2 EA
Recommended Torque Value	Steel Band Fixing Screw		48.5 lbf·in (56.1 kgf·cm)
Working Tools	• Torque Driver (20 to 90 lbf·in) • Screw Driver Bit ('+', No. 3) • Compass		

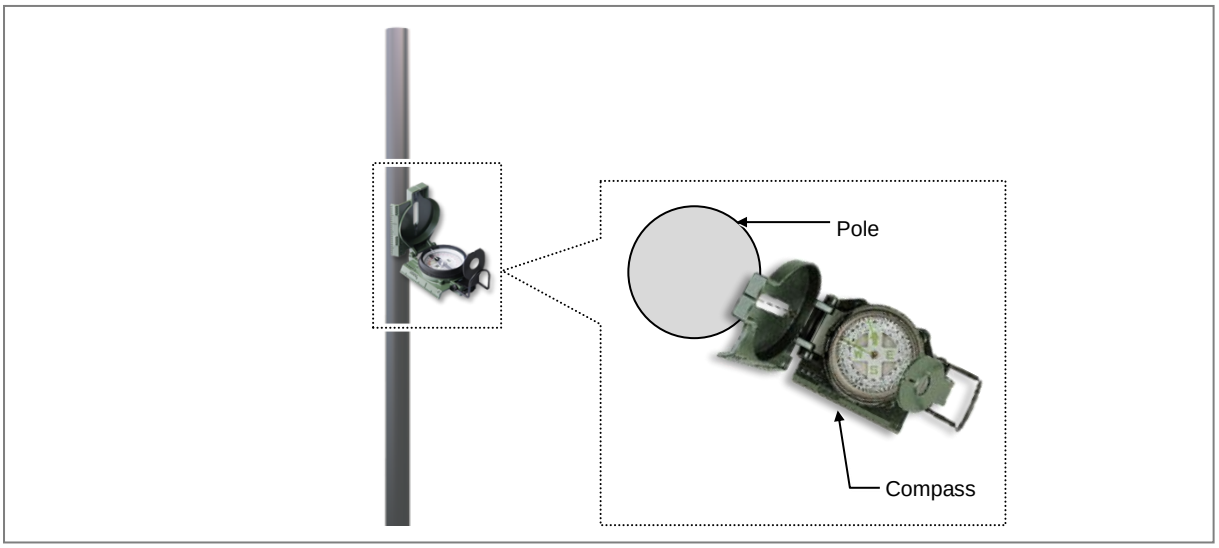
1 Pass the steel band through the fixing hole of the mounting brackets.

Figure 64. Fixing Mounting Bracket on the Pole (1)



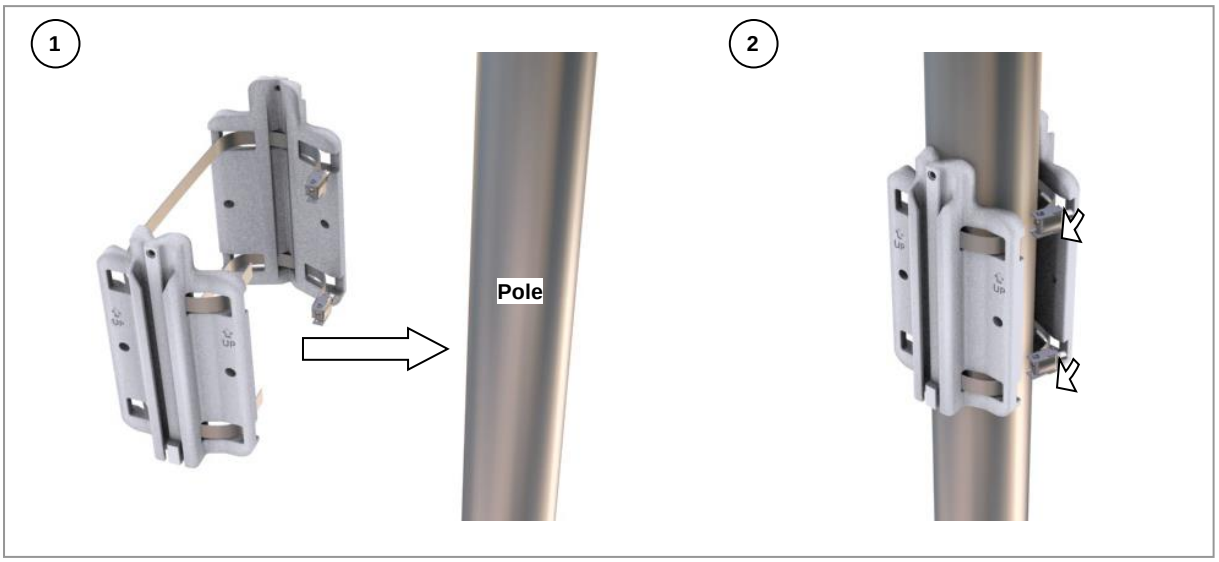
2 Use a compass to determine the azimuth of the HRU to be installed on the pole.

Figure 65. Fixing Mounting Bracket on the Pole (2)



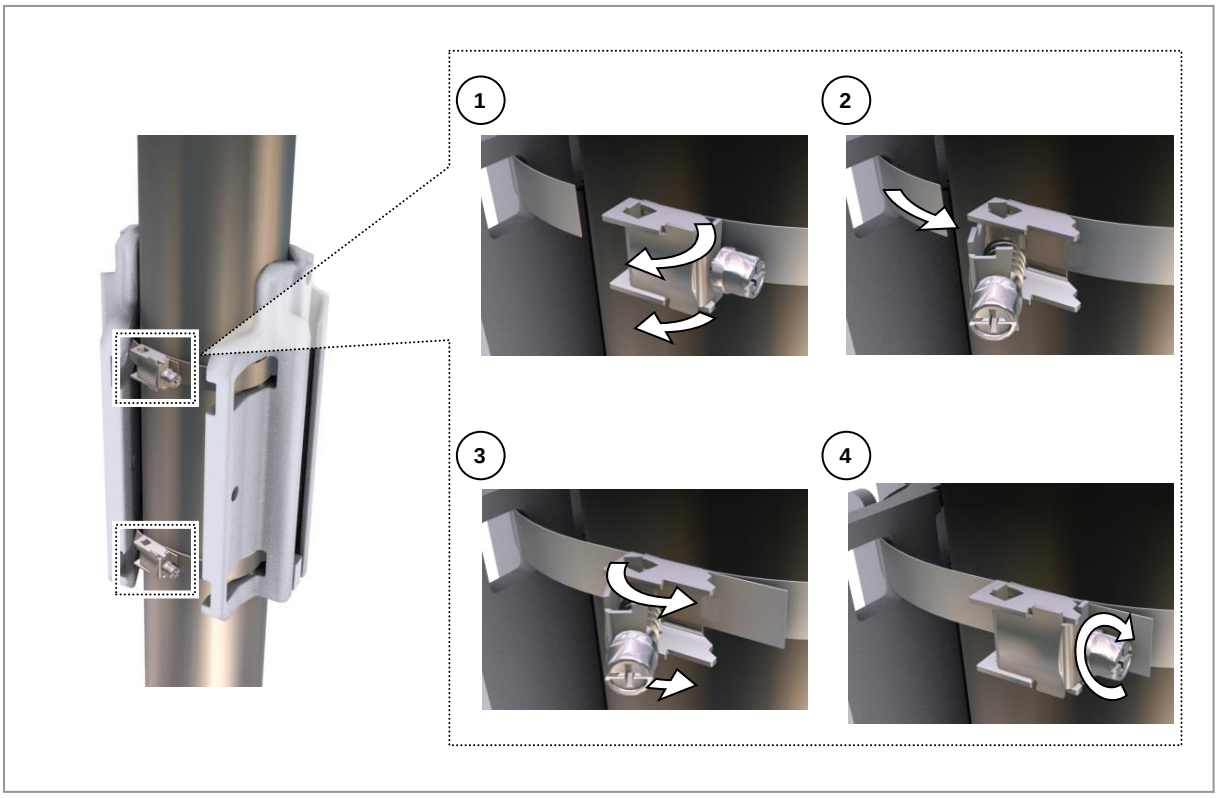
3 Place the mounting brackets to the pole.

Figure 66. Fixing Mounting Bracket on the Pole (3)



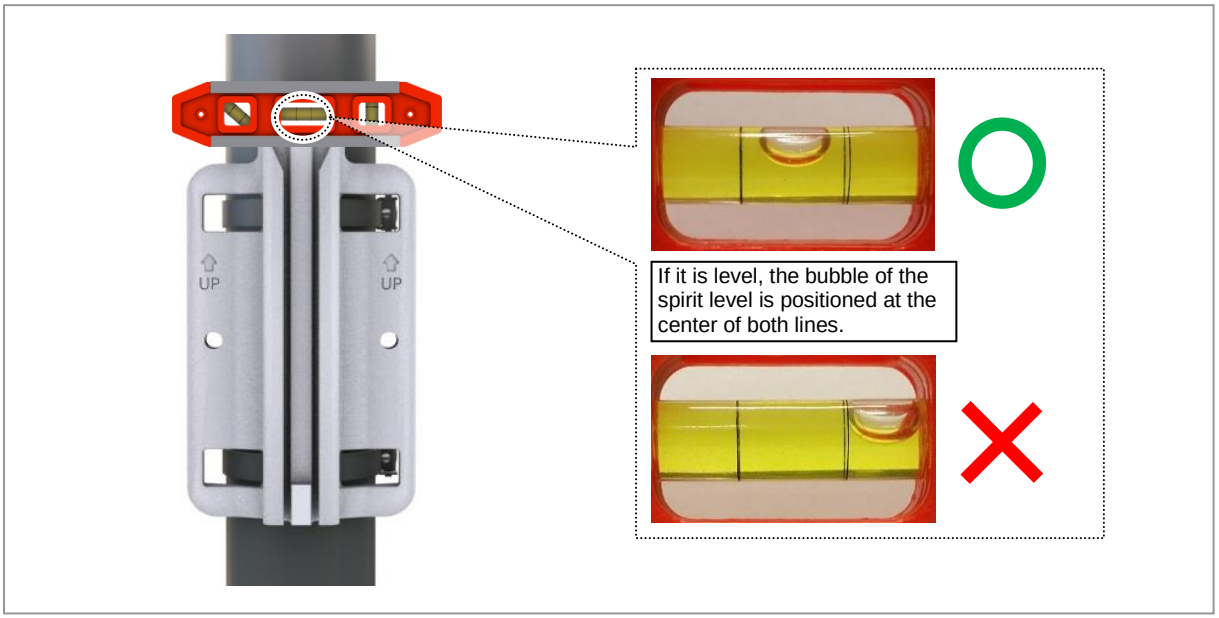
4 Fix the mounting brackets to the pole using the steel band.

Figure 67. Fixing Mounting Bracket on the Pole (4)



5 Check the level of each mounting brackets on the pole and adjust the level.

Figure 68. Fixing Mounting Bracket on the Pole (5)



When fixing the mounting bracket on the pole, ensure to check the level of bracket. After finishing the installation, adjust the level minutely.

When poor leveling happens, adjust the position of fasteners used to fix the mounting bracket.

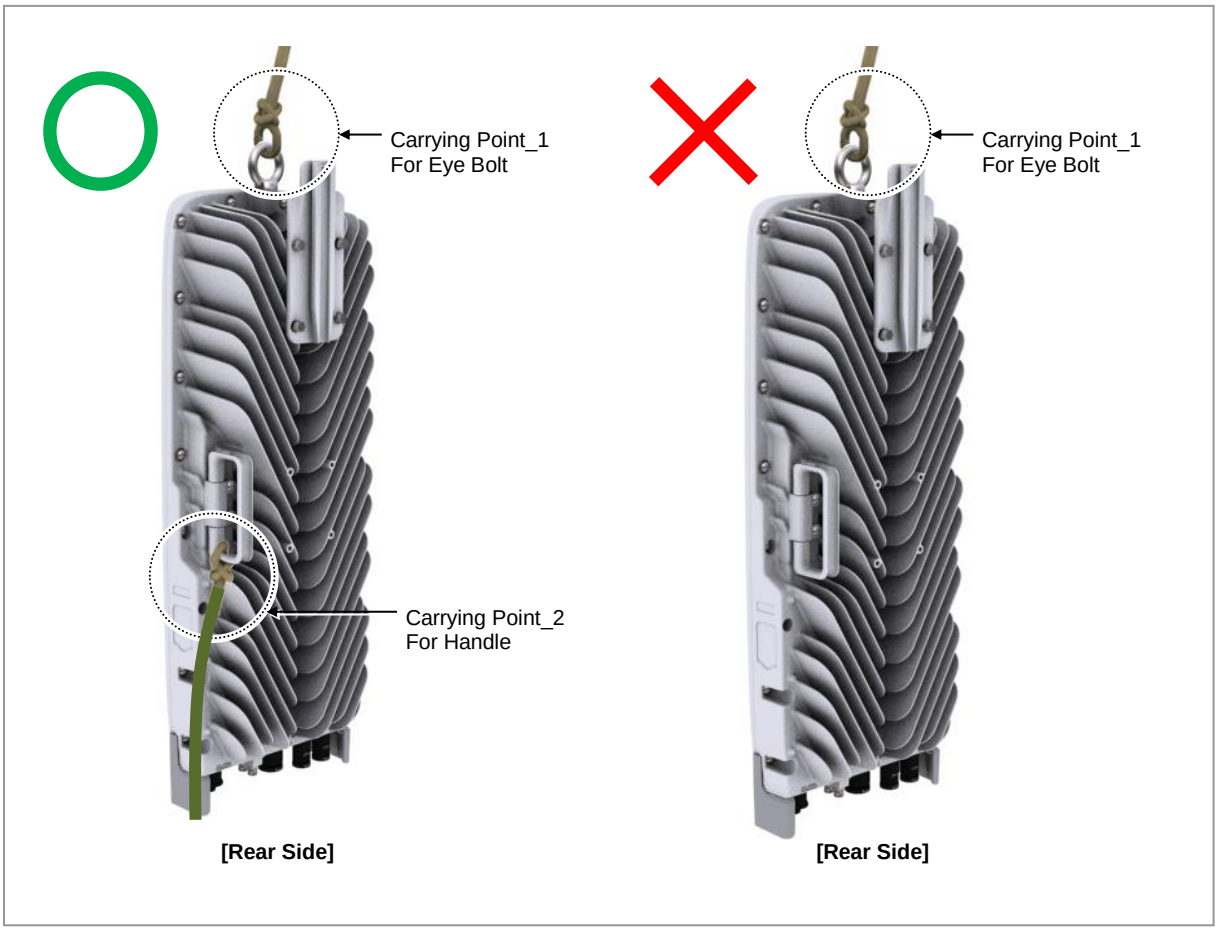
After fixing the steel band, push the remainder of band inside the mounting bracket

Lifting HRUs

To lift the HRU, do the following:

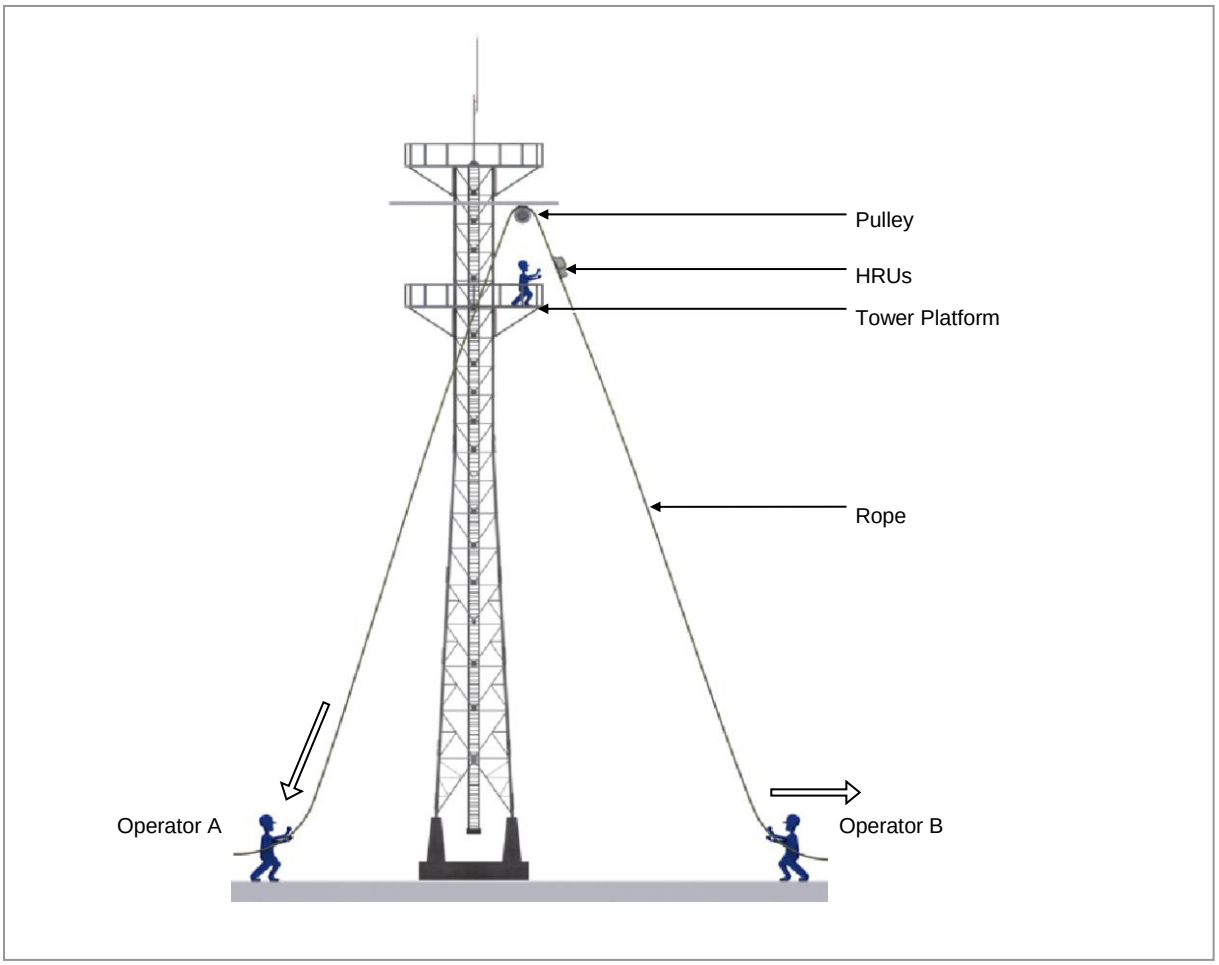
1 Tie the rope in two carrying points of the HRUs.

Figure 69. Lifting HRUs (1)



2 While Operator A hauls the rope to carry up the HRUs, Operator B pulls the rope outward, so that the HRUs would not hit the tower platform.

Figure 70. Lifting HRUs (2)



Fixing HRUs on the Pole

To fix the HRU on the pole, do the following:

Prerequisites

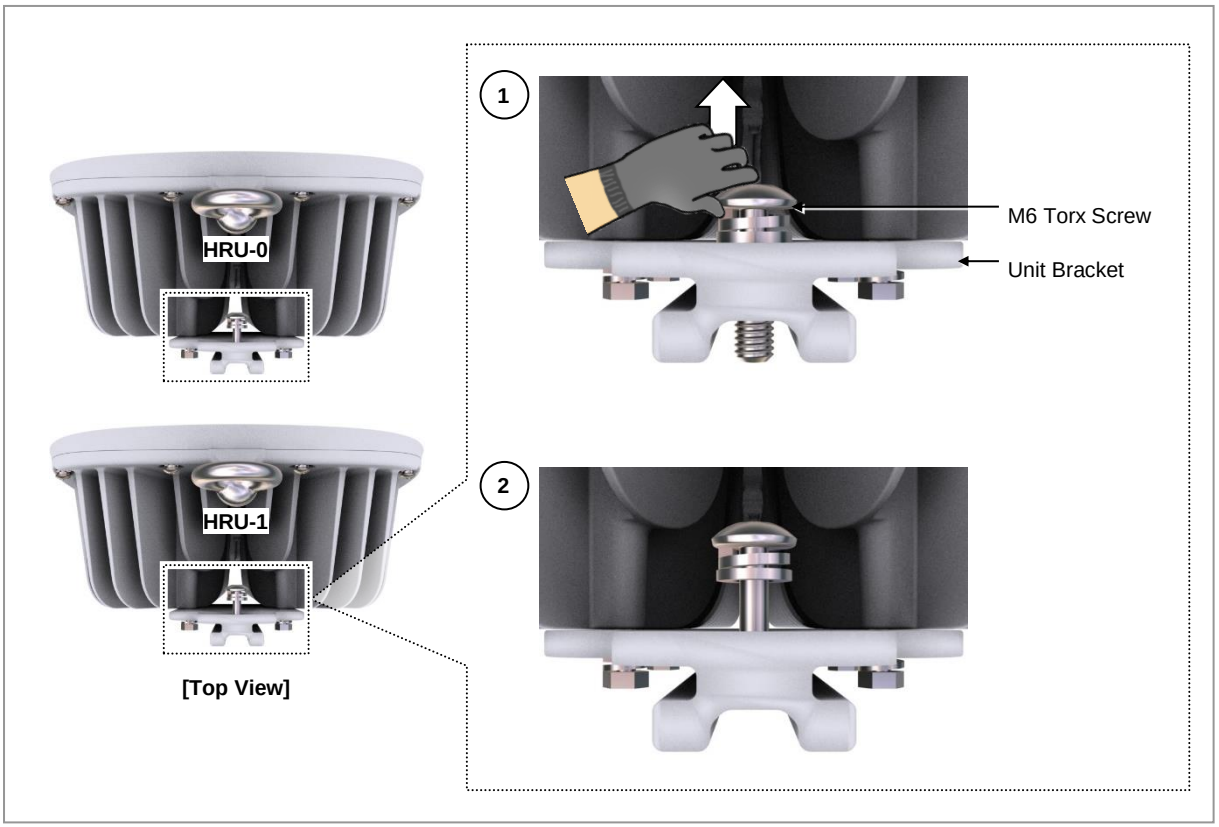
Before proceeding with fixing the HRU on the pole, make sure that you have the items mentioned in the table below:

Table 19. Tools for Fixing HRUs on the Pole

Category	Description	
Recommended Torque Value	M6 Torx Screw	43 lbf·in (50 kgf·cm)
Working Tools	• Torx Driver Bit (T30H) • Torque Driver (20 to 90 lbf·in) • Compass	

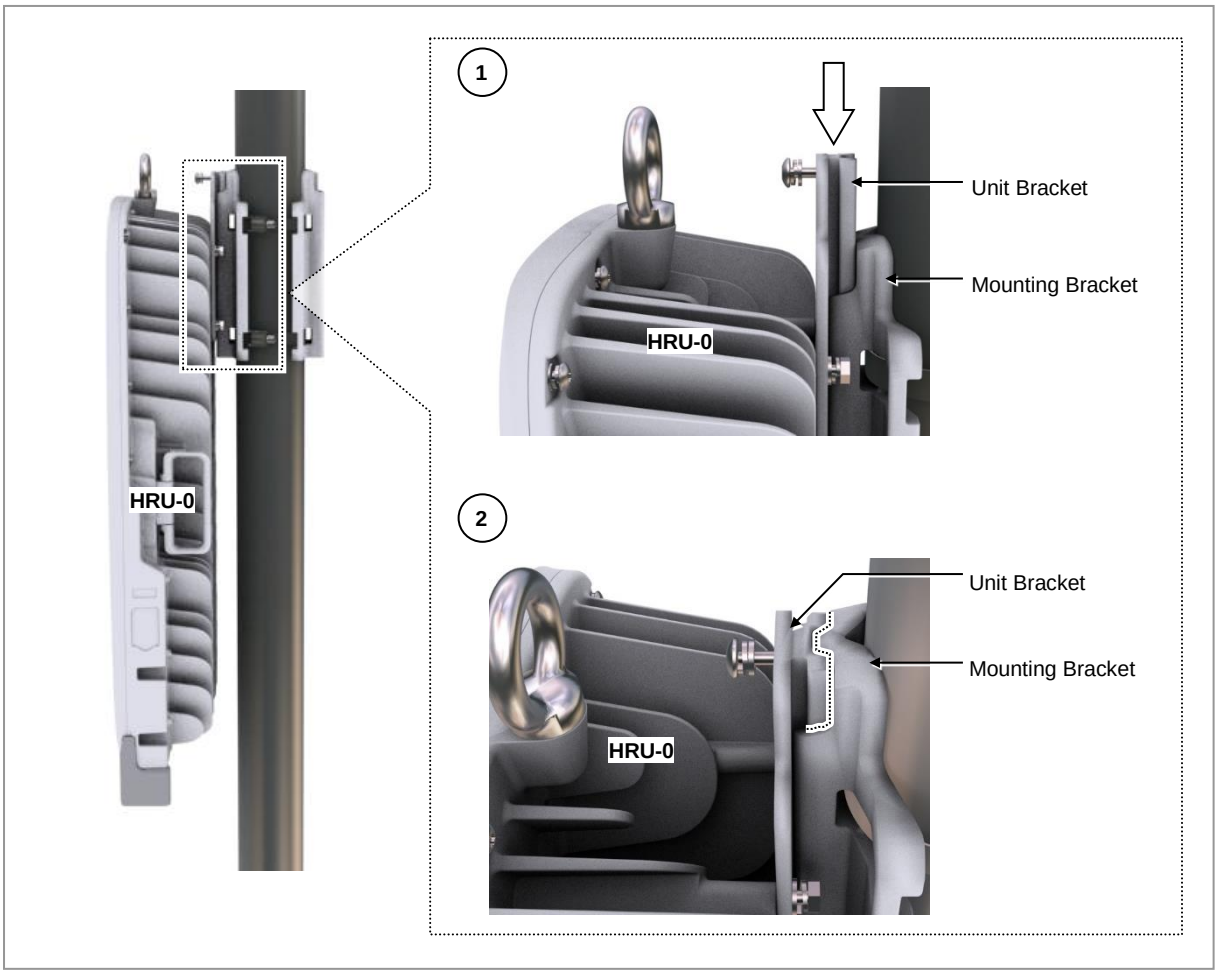
1 Pull out the fastening materials so that they do not jut out from the fixing groove of the unit bracket.
Do not pull out completely.

***Figure 71.** Fixing HRUs on the Pole (1)*



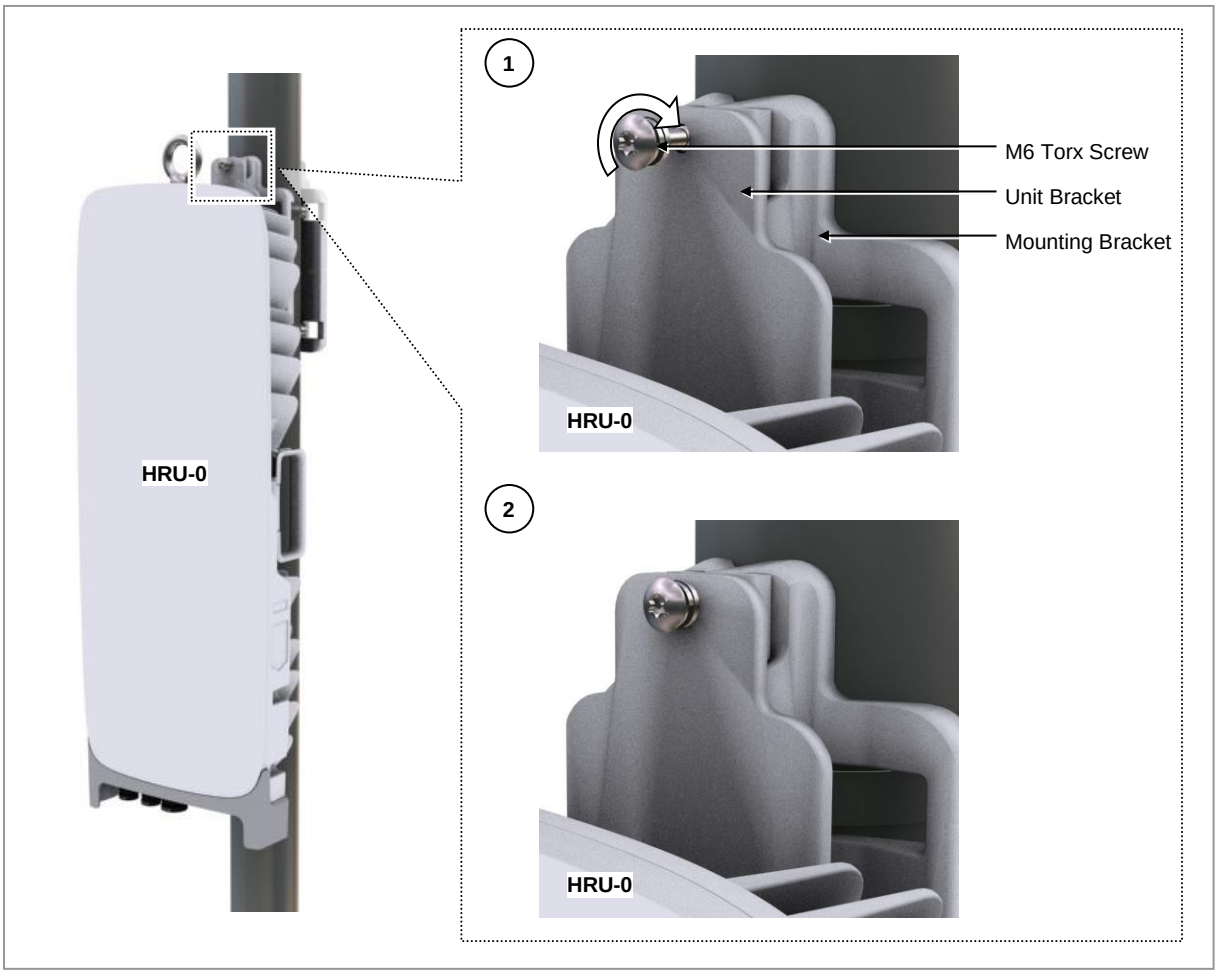
2 Place the unit bracket on the fixing grooves of the mounting bracket and push the unit bracket down to fix the HRU-0 in place.

Figure 72. Fixing HRUs on the Pole (2)



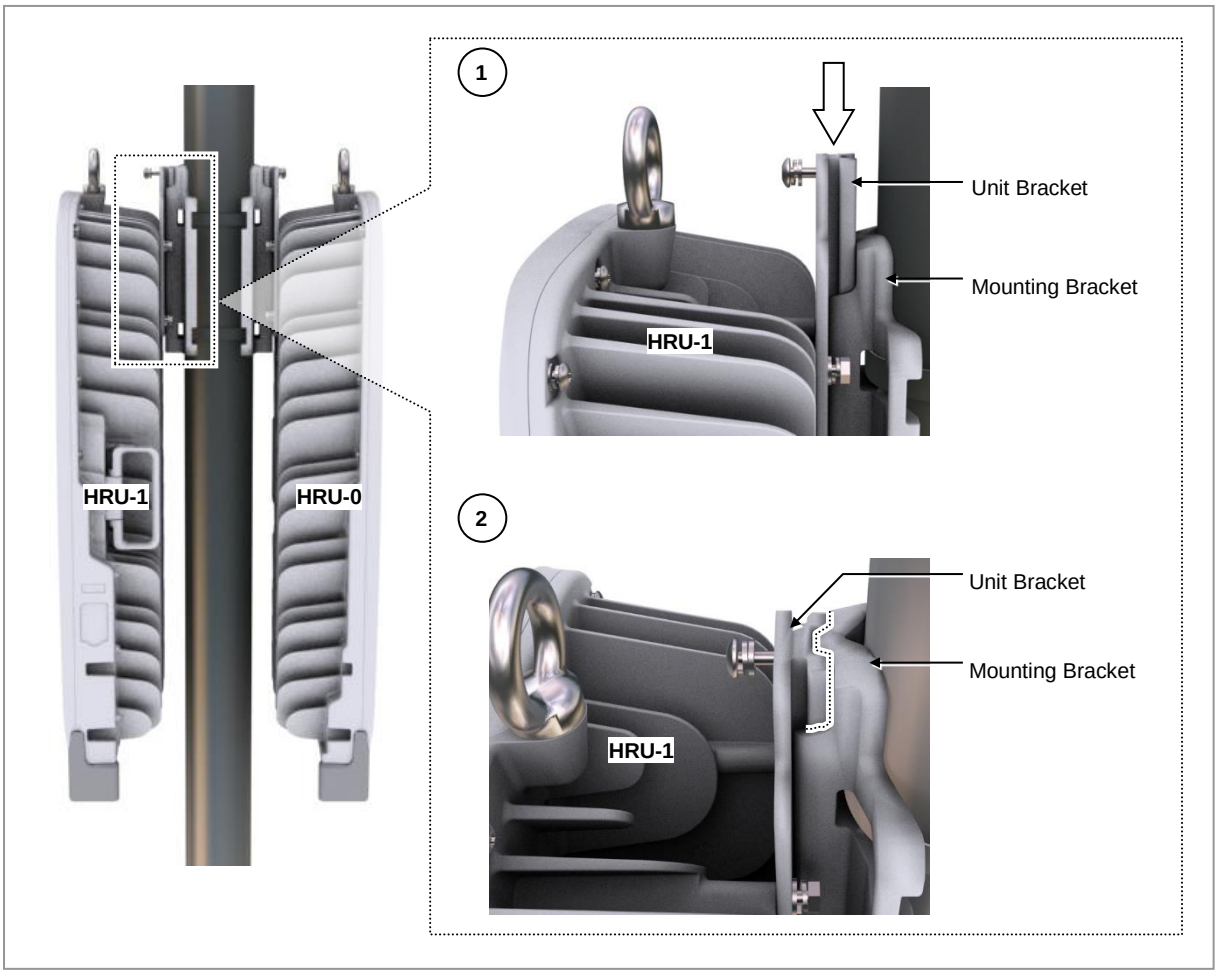
3 Fix the unit bracket of the HRU-0 to the mounting bracket using the fastener.

Figure 73. Fixing HRUs on the Pole (3)



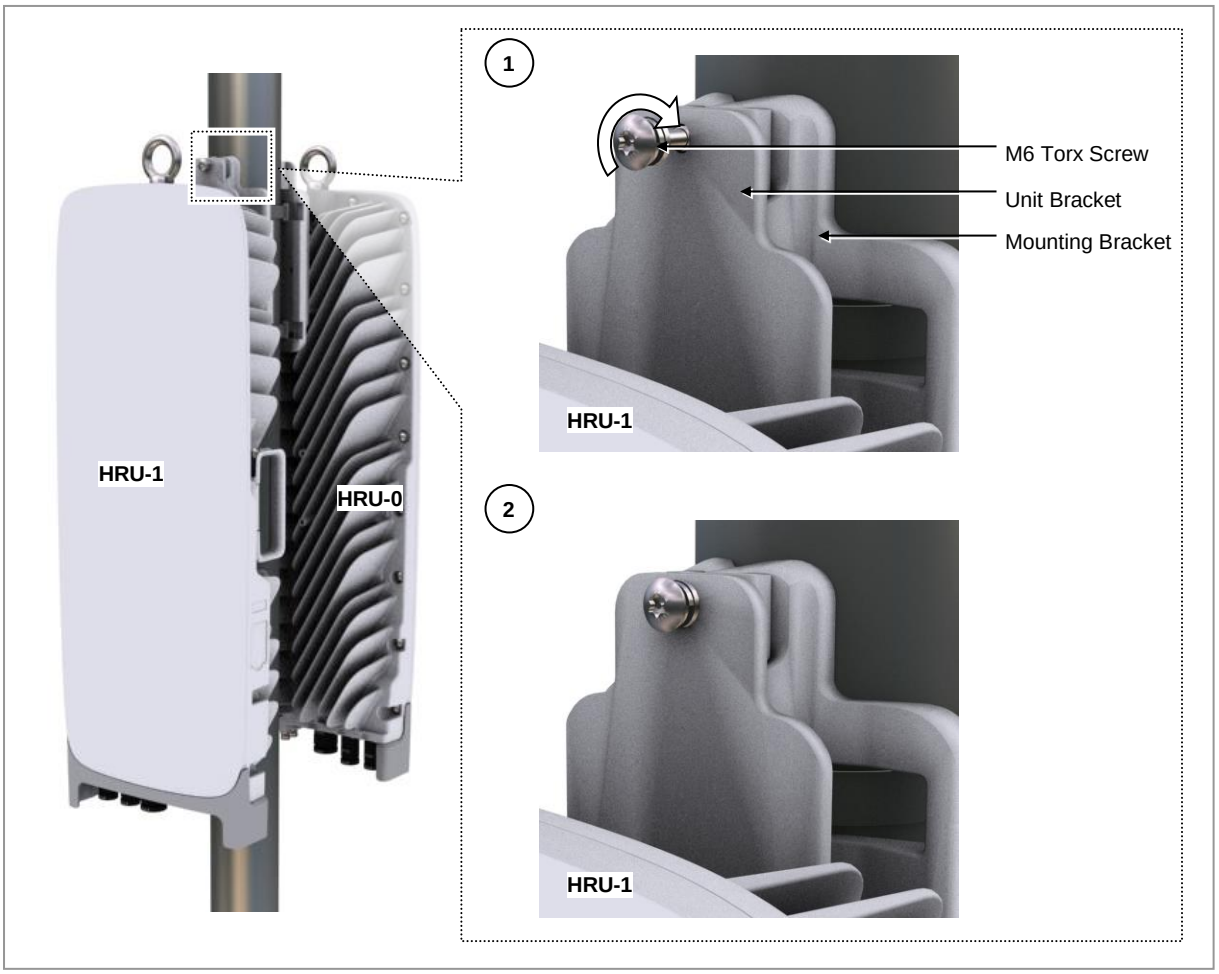
4 Place the unit bracket on the fixing grooves of the mounting bracket and push the unit bracket down to fix the HRU-1 in place.

Figure 74. Fixing HRUs on the Pole (4)



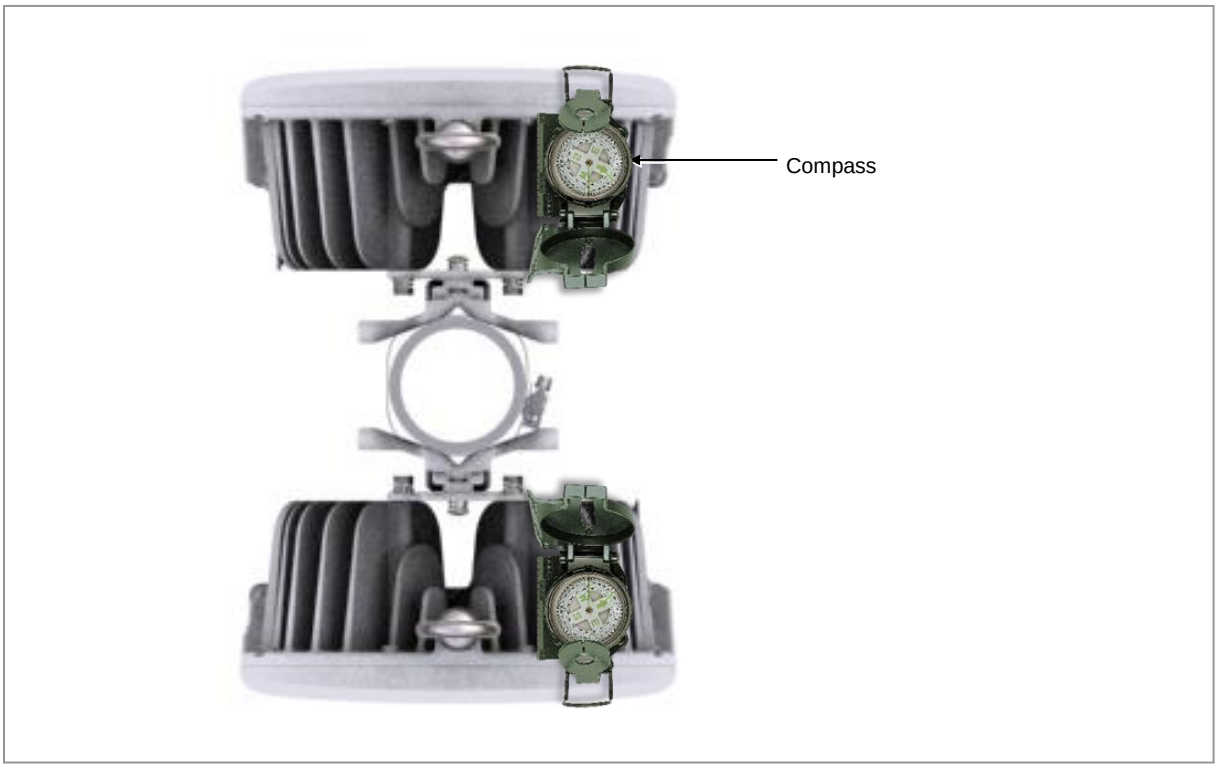
5 Fix the unit bracket of the HRU-1 to the mounting bracket using fastener.

Figure 75. Fixing HRUs on the Pole (5)



6 Use the compass to check the azimuth of the front of the HRU.

Figure 76. Fixing HRUs on the Pole (6)



Using Chain Bracket

This section describes the procedures to fix the zero-bolt unit bracket and the HRU on the pole.

Fixing Zero-Bolt Unit Bracket

The instructions for mounting a zero-bolt unit bracket to the HRU apply to all installation types.

To fix the Zero-bolt unit bracket, do the following:

Prerequisites

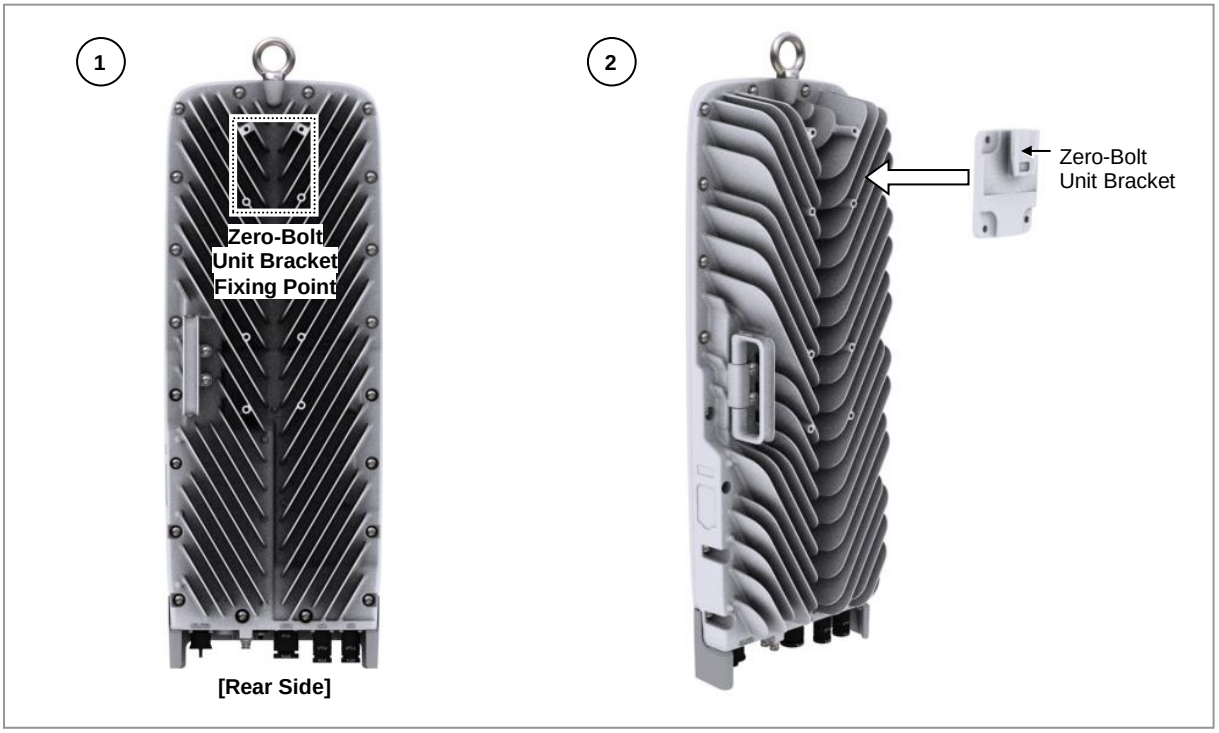
Before proceeding with fixing the zero bolt unit bracket, make sure that you have the items mentioned in the table below:

Table 20. Parts and Tools for Fixing Unit Bracket on HRU

Category	Description		
Parts	Zero-Bolt Unit Bracket		1 EA/HRU
	Fasteners	M6 × L20 Hex. Bolt (Washer assembly)	4 EA/HRU
Recommended Torque Value	M6 Hex. Bolt		43 lbf·in (50 kgf·cm)
Working Tools	• Torque Wrench (10 to 50 lbf·in) • Torque Wrench Spanner Head (apply hexagon head: 10 mm)		

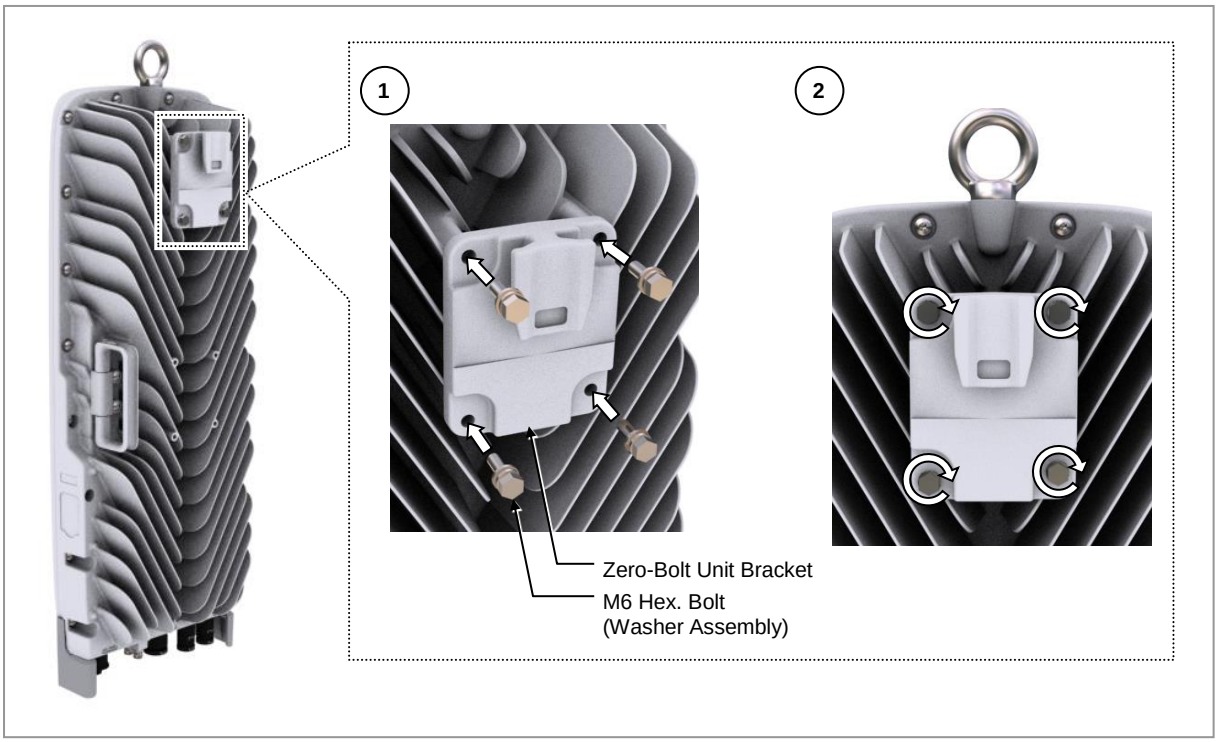
1 Check the position for mounting the zero-bolt unit bracket on the back of the HRU and place it in that position.

Figure 77. Fixing Zero-Bolt Unit Bracket (1)



2 Fix the unit bracket using the fasteners.

Figure 78. Fixing Zero-Bolt Unit Bracket (2)



Fixing Pole Type

This section describes the procedure to fix the HRU on the pole.

Adjustment Chain Bracket Size for 3 Sector

After checking the size of the pole to install the chain bracket, add/remove the module bracket of the chain bracket according to the size of the pole.

Pole Size	Module Bracket Quantity
125 A	4 EA
150 A	5 EA
200 A	6 EA
250 A	8 EA
300 A	9 EA
350 A	10 EA

To adjust the chain bracket size, do the following:

Prerequisites

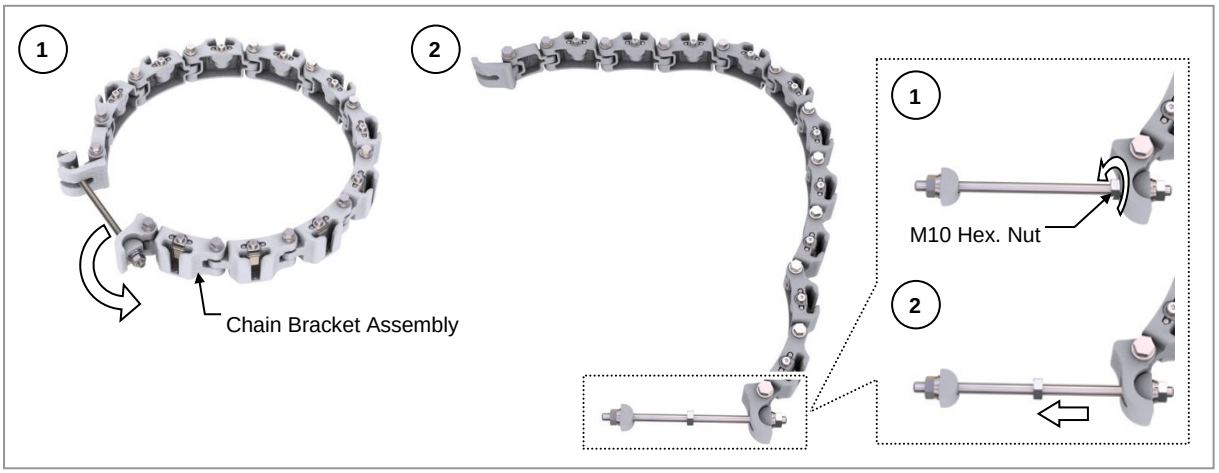
Before proceeding with adjusting the chain bracket size, make sure that you have the items mentioned in the table below:

Table 21. Parts and Tools for Adjustment Chain Bracket Size

Category	Description	
Parts	Chain Bracket Assembly	1 Set
Recommended Torque Value	M8 Hex. Bolt	110 lbf·in (127 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagon head: 13 mm) • Spanner (hexagon head: 13 mm) • Spanner (hexagon head: 17 mm)	

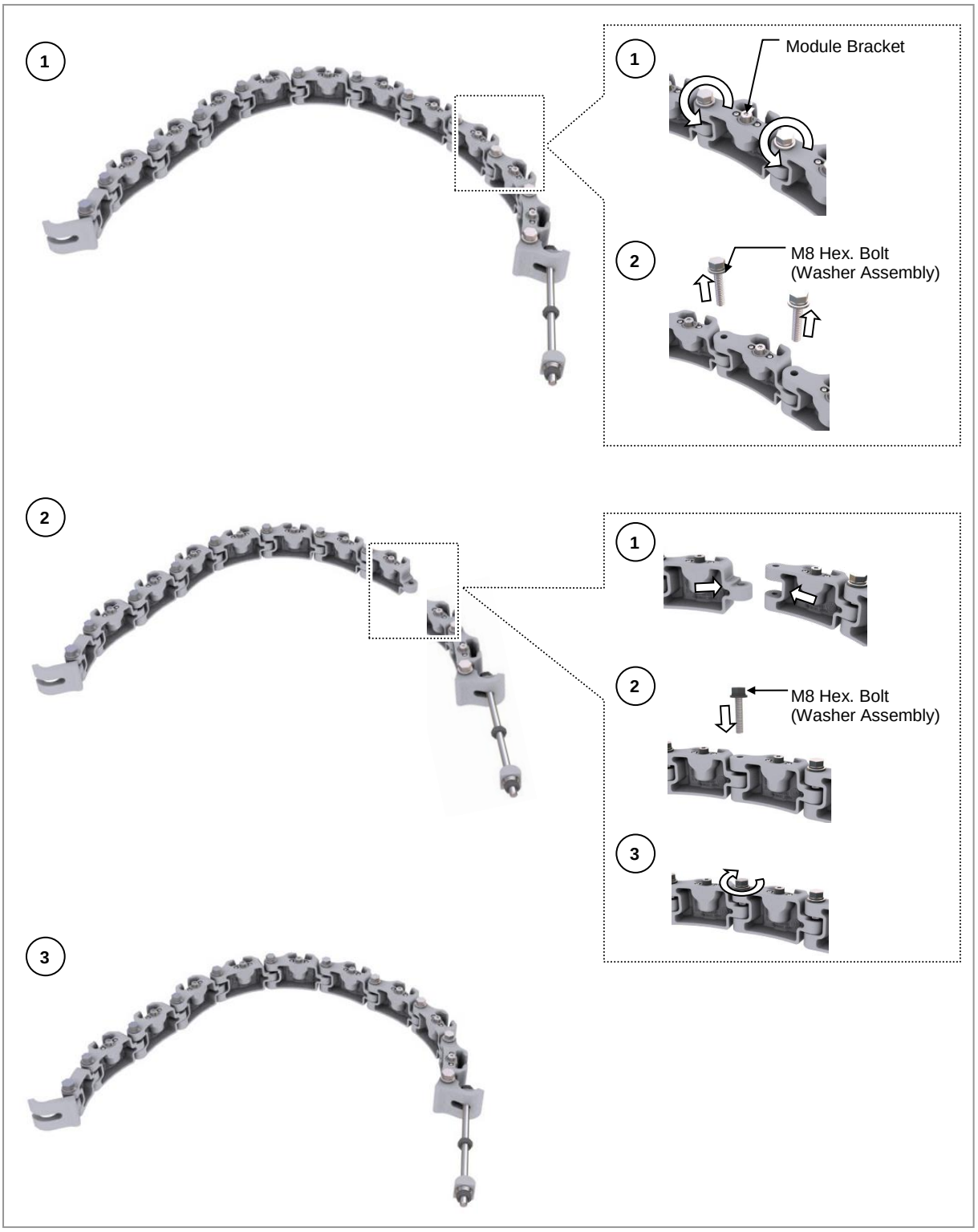
1 Spread out the chain bracket assembly and place the hexagonal nuts in the middle of the stud bolts.

Figure 79. Adjustment Chain Bracket Size (1)



2 Adjust the size of the chain bracket by adjusting the module bracket to match the size of the pole.

***Figure 80.** Adjustment Chain Bracket Size (2)*



Fixing Chain Bracket Assembly on the Pole

The following procedure is based on the 3 sector type that is installed on a 350 A

pole (OD: 14 in./355.6 mm).

To fix the chain bracket assembly on the pole, do the following:

Prerequisites

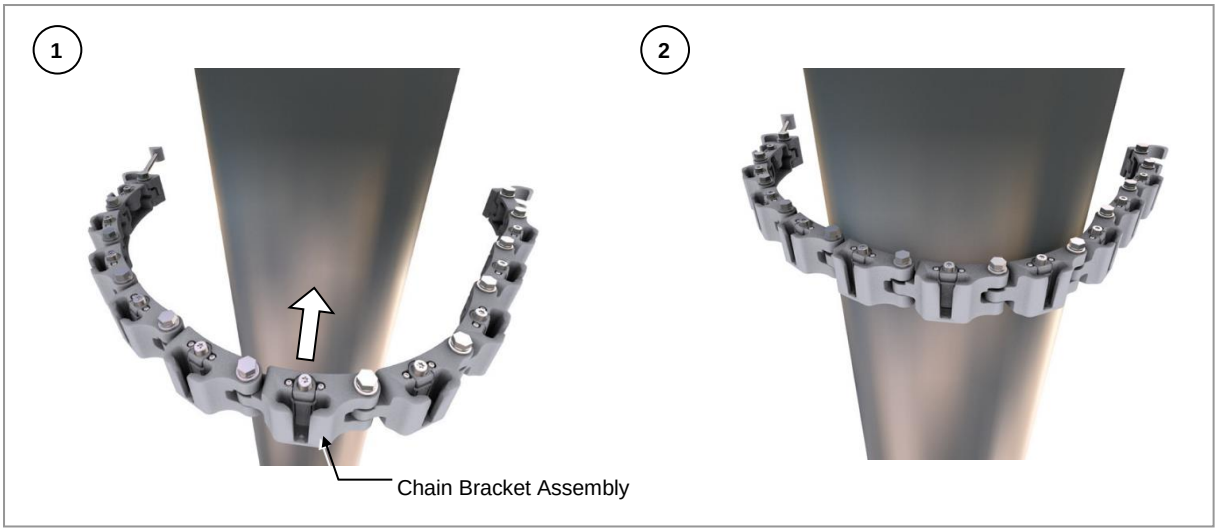
Before proceeding with fixing the chain bracket assembly on the pole, make sure that you have the items mentioned in the table below:

Table 22. Parts and Tools for Fixing Chain Bracket Assembly on the Pole

Category	Description	
Parts	Chain Bracket Assembly	1 Set
Recommended Torque Value	M10 Hexagonal nut	217 lbf·in (250 kgf·cm)
Working Tools	• Torque Wrench (100 to 400 lbf·in) • Torque Wrench Spanner Head (apply hexagonal head: 17 mm) • Spanner (hexagon head: 17 mm)	

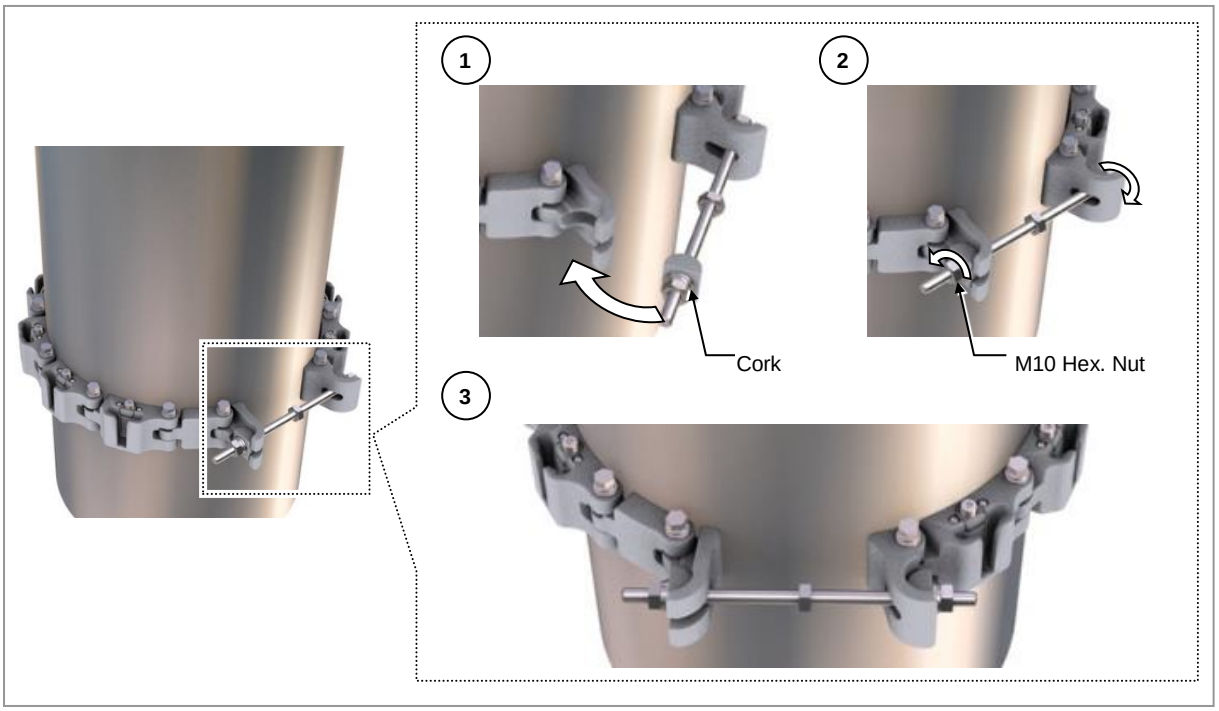
1 Open the chain bracket assembly and place it in the position on the pole where the HRUs are to be installed.

Figure 81. Fixing Chain Bracket Assembly on the Pole (1)

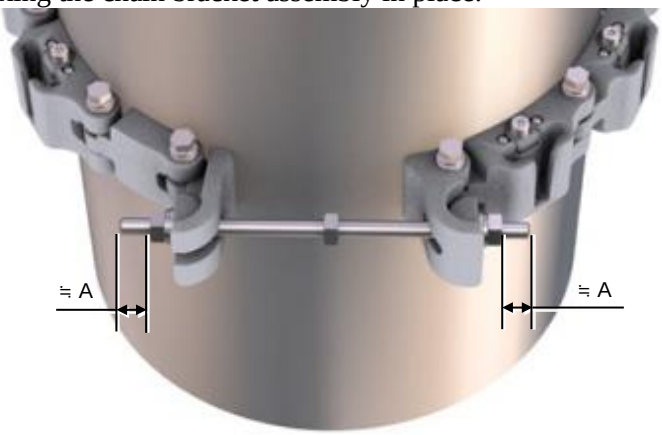


2 Fix the chain bracket assembly in place temporarily using the hexagonal nuts on each side of the stud bolt.

Figure 82. Fixing Chain Bracket Assembly on the Pole (2)

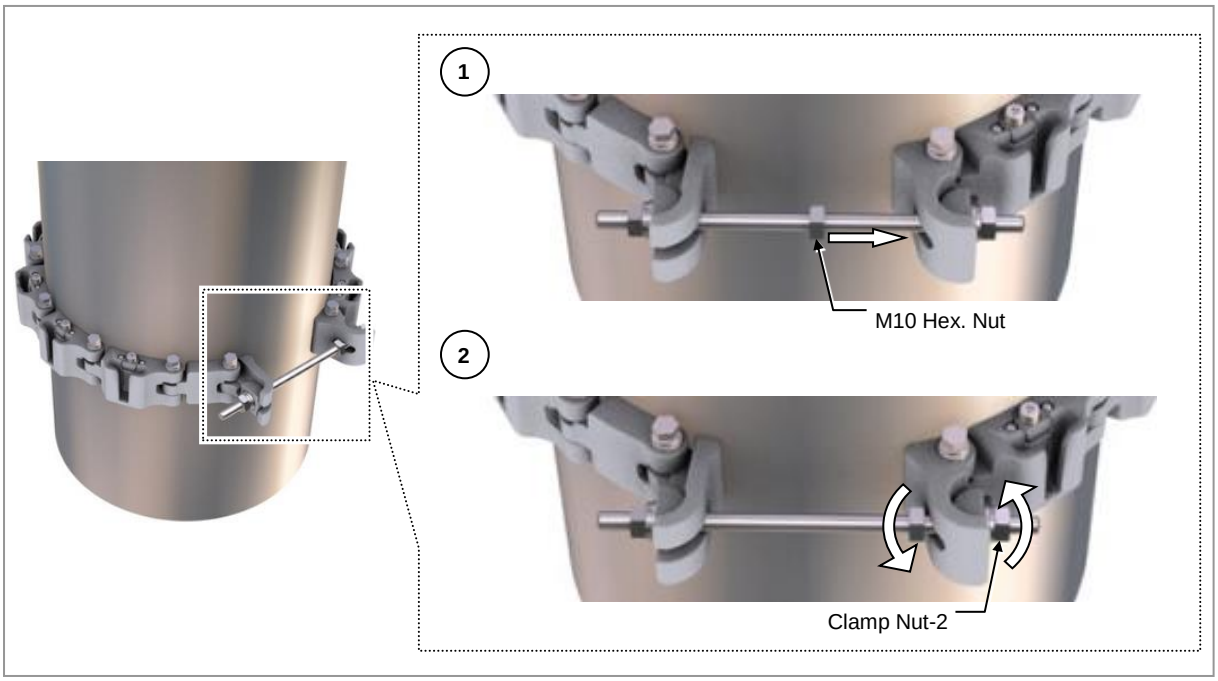


The extra space on each side of the stud bolt (A) must be equal when temporarily fixing the chain bracket assembly in place.



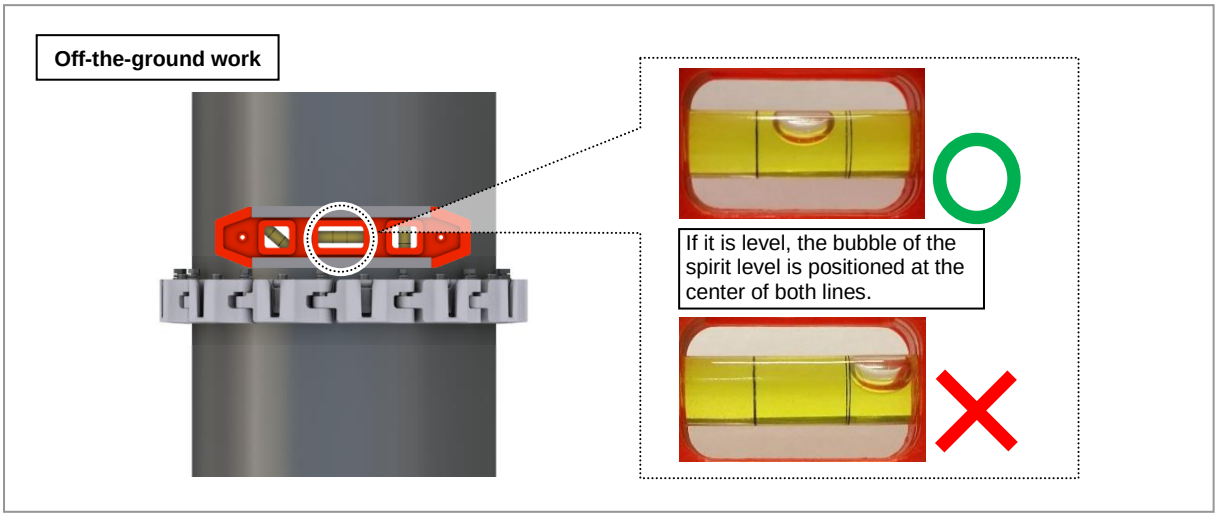
3 Use the hexagonal nut in the centre of the stud bolt to fix the clamp nut-2 in place.

Figure 83. Fixing Chain Bracket Assembly on the Pole (3)



4 Check the level of chain bracket assembly on a pole and adjust the level.

Figure 84. Fixing Chain Bracket Assembly on the Pole (4)



When fixing the chain bracket assembly on the pole, ensure to check the level of bracket. After finishing the installation, adjust the level minutely.

If the leveling is poor, adjust the position of fasteners used to fix the chain bracket assembly.

Lifting HRU

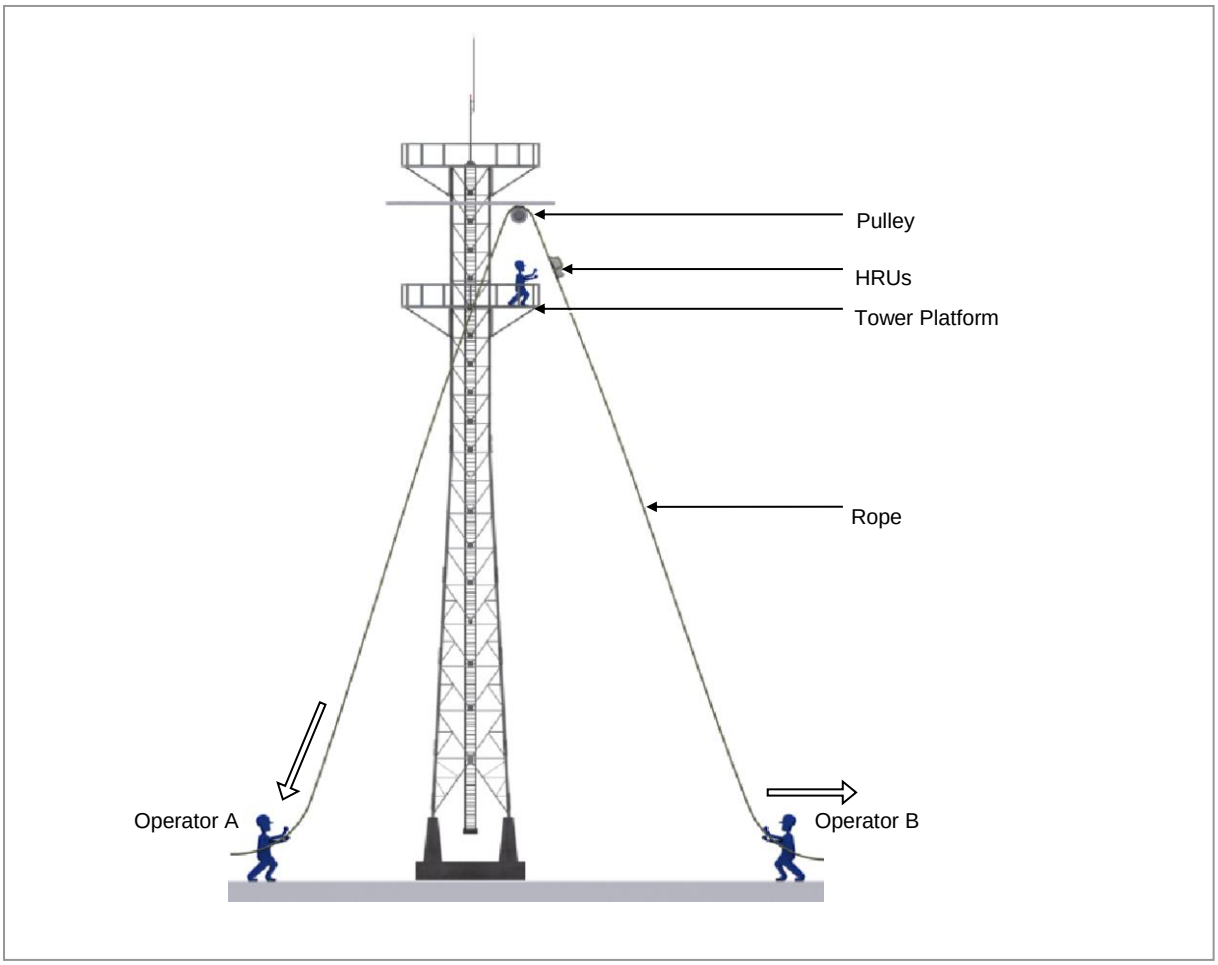
To lift the HRU, do the following:

1 Tie the rope in two carrying points of the HRU.

Figure 85. Lifting HRUs (1)

2 While Operator A hauls the rope to carry up the HRUs, Operator B pulls the rope outward, so that the HRU would not hit the tower platform.

Figure 86. Lifting HRUs (2)



Fixing HRUs on the Pole

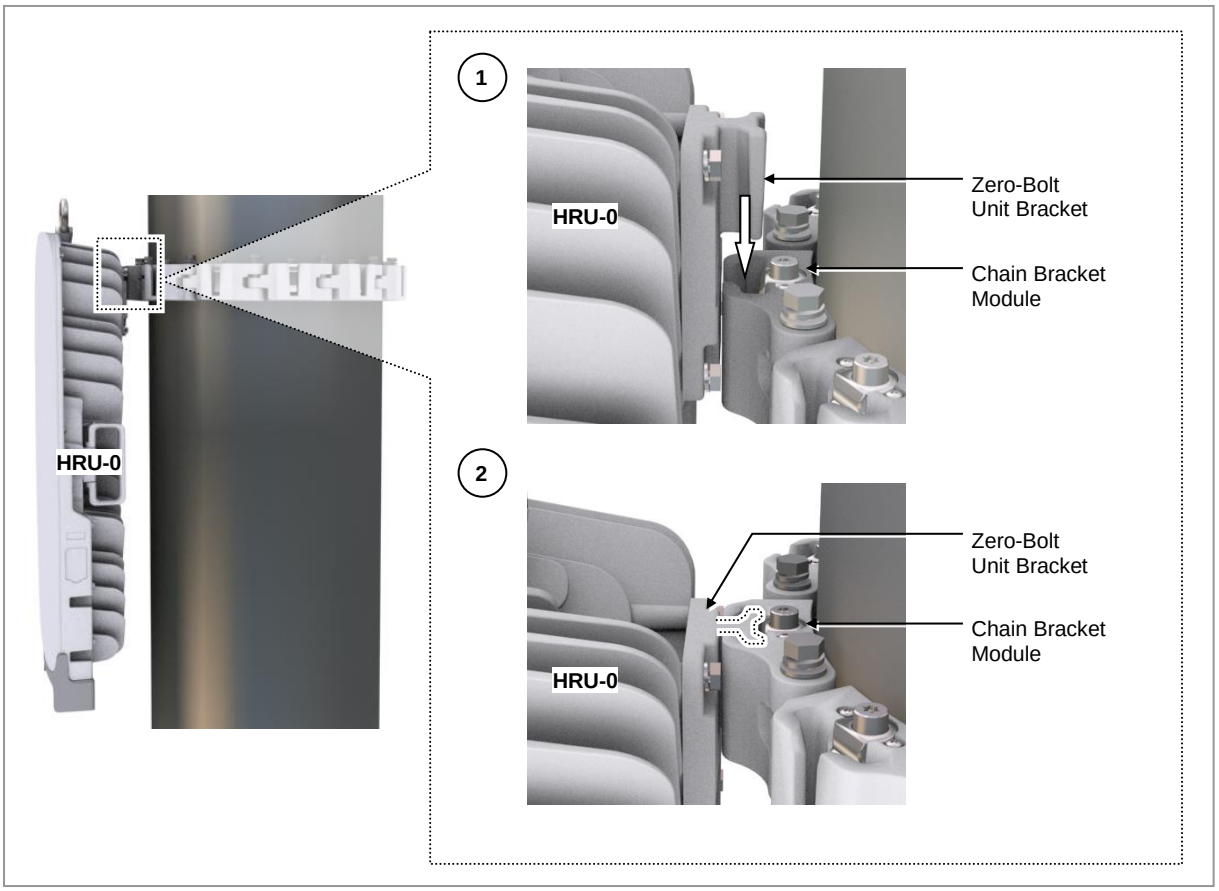
Check the location for installing the HRU for each module before mounting the chain bracket to the HRU.

[Example: Mounting location for each HRU]

To fix the HRU on the pole, do the following:

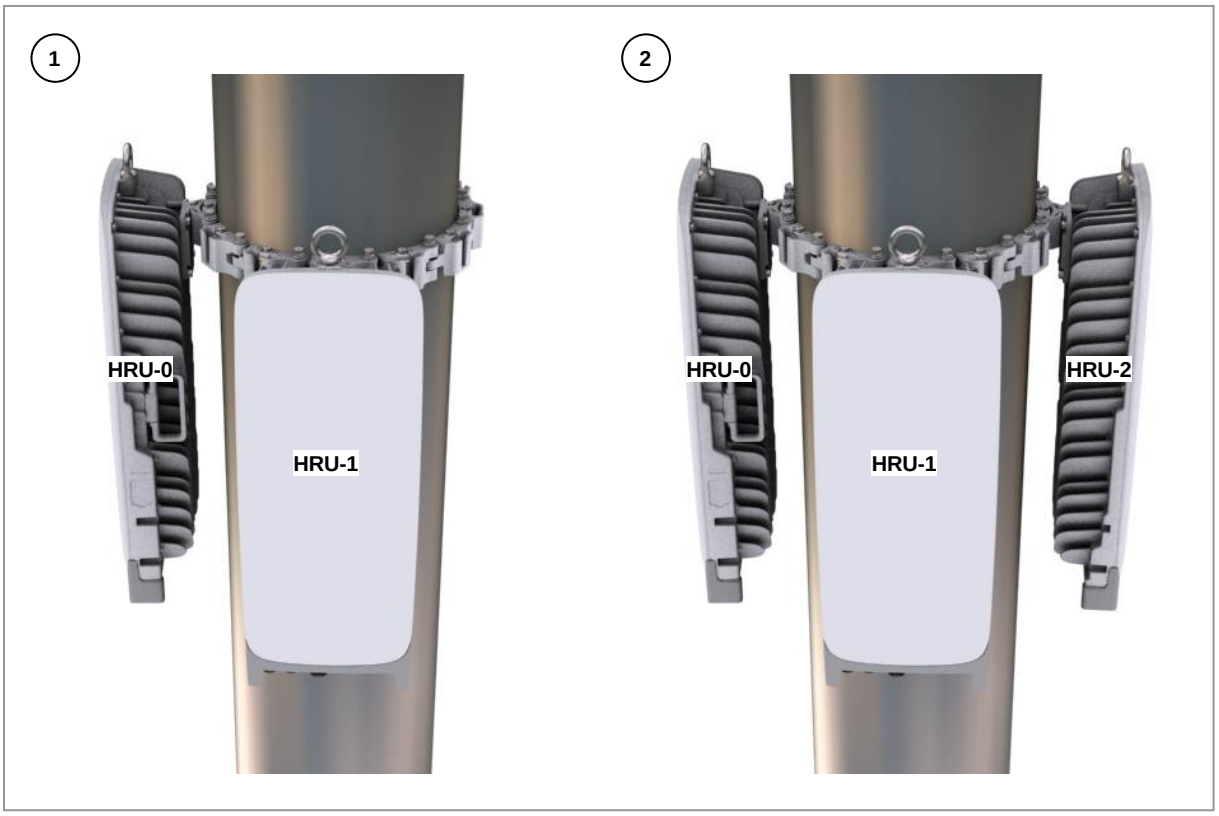
1 Place the zero-bolt unit bracket on the fixing grooves of the chain bracket and push the zero-bolt bracket down until it clicks to fix the HRU-0 in place.

Figure 87. Fixing HRUs on the Pole (1)



2 Fix the HRU-1 and HRU-2 using the same method.

Figure 88. Fixing HRUs on the Pole (2)



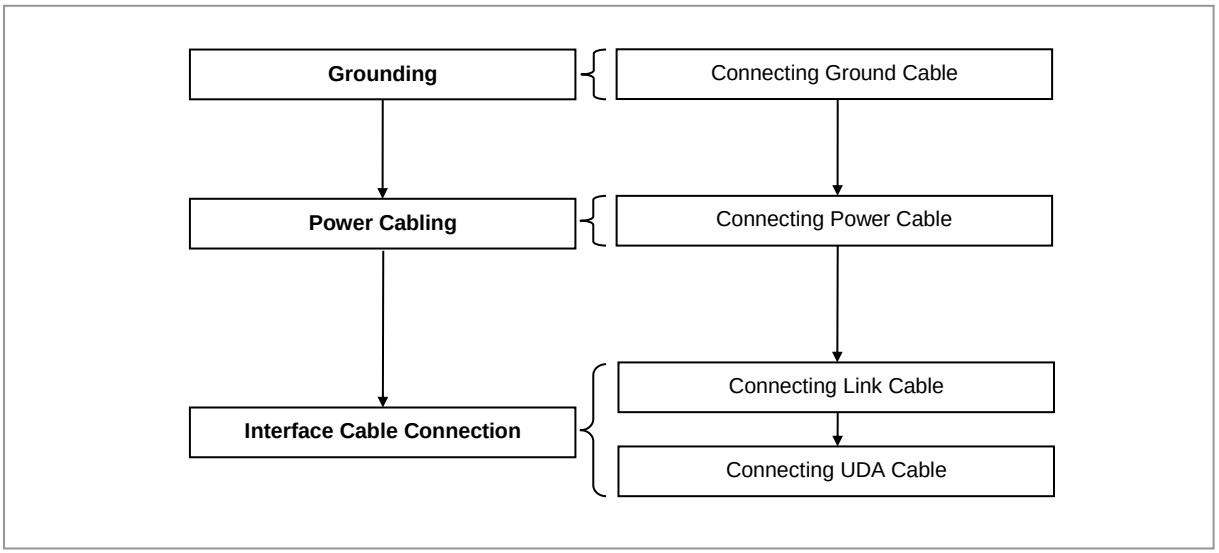
Chapter 3 Connecting Cables

This chapter describes the procedures to connect cables to the HRU system and to label the cables.

Cabling Procedure

The figure below depicts the procedure to connect system cables:

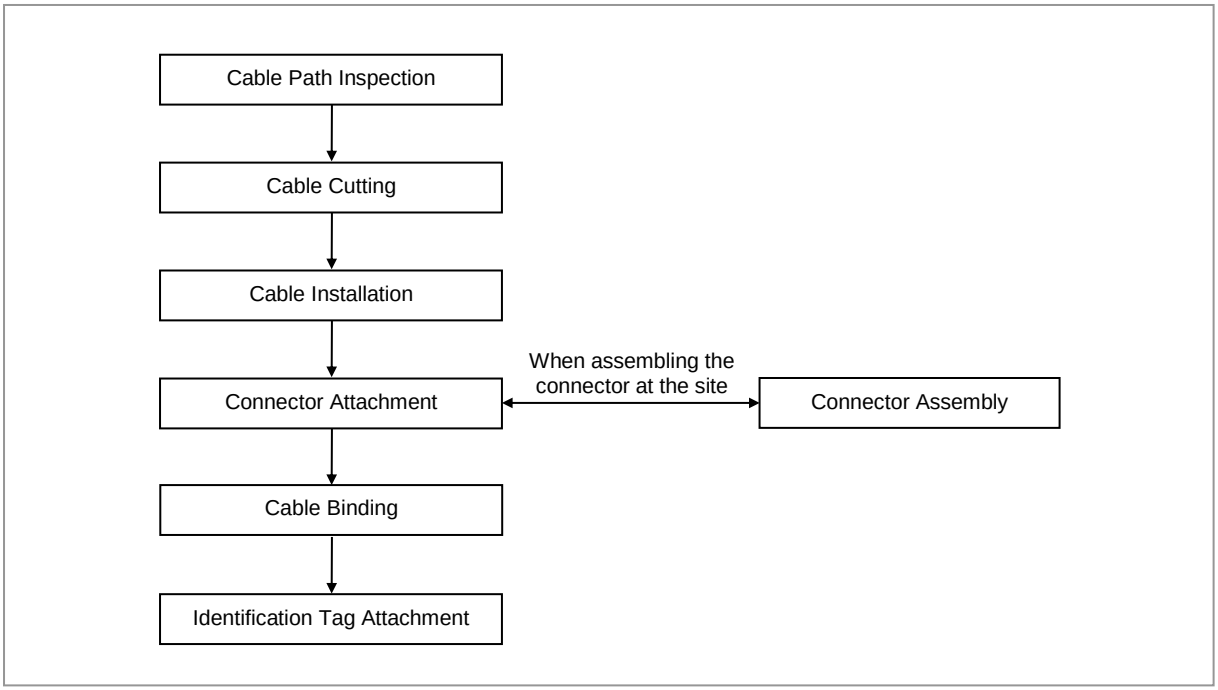
Figure 89. Procedure to Connect System Cable



Guidelines for Cable Connections

The figure below depicts the sequence of operations for connecting cables to the system:

Figure 90. Cable Connection Procedure



When cutting the cable after installation, ensure that the connector is disconnected. The cable installation while the connector is connected to the system may cause contact failure, or damage to the assembled connector and the cable, due to cable tension or operator mistakes.

The sequence of cable cutting and installation of the cable workflow can be changed depending on the field situation such as cutting after installing or installing after cutting.

Cable Path Inspection

When installing the cable that interconnects rectifier, Main Ground Bar (MGB), backhaul device, and so on within the system, the cable path, length, and cable installation method must be inspected.

To inspect the cable path, ensure the following.

- A minimum cable length must be selected, so that the length does not affect the cable installation and maintenance.

- The cable must be placed in a location where the cable is not damaged by external factors such as power line, flooding, and footpaths.
- In areas where the cable may be damaged by external factors, ensure that measures are taken to prevent damage to the cable, such as cable tray, ducts, and flexible pipe.

Cable Cutting

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

To cut the cable, follow these guidelines:

- 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 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

This process involves running the cable along the cabling path to the target connector of the system or an auxiliary device. This is done after cable path inspection and cable cutting are completed.

To install the cable, follow these guidelines:

- Be careful not to damage the cable.
- If the cable is damaged, cut out the damaged section before installing, or replace the cable.
- Run the cable so that it is not tangled. In particular, when installing the 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 ensure that the minimum curvature radius specification is complied with.
- If the cable needs to be protected, use suitable protective cover such as PVC channel, spiral sleeve, flexible pipe, and cable rack.
- Install the DC power cable and the data transmission cable away from the AC power cable to prevent electromagnetic induction.

The table below outlines the recommended minimum allowed cable bend radius for different types of cables:

Table 23. Recommended Minimum Allowed Cable Bend Radius

No	Type	Allowed Cable Bend Radius
1	Ground/Power Cable	8 × OD
2	Optical Cable (Outdoor, Multi, MPO)	10 × OD
3	S-FTP Cable (Cat6a)	5 × OD

If the allowed cable bend radius is specified by the manufacturer, comply with the bend radius specified.
- OD: Outer Diameter

Cable Binding

This process involves fixing and arranging an installed cable using binding thread, cable ties, binding wire, and ram clamps.

Follow these guidelines when binding a cable.

- Be careful not to damage the cable during binding.
- Use proper cable binding tools according to the target location (indoor or outdoor) and the type of the cable (power supply cable, optical cable, or feeder line).
- Ensure the cutting sections of the cable tie and the binding line are not exposed to the outside. This may cause damage to the cables or personal injury.
- Cut off the remainder of the cable thread by leaving about 50 mm of extra length to prevent the knot from easily getting untied.
- If there is a chance of contact-failure to occur in the connector connection due to tension, bind the cable at the closest location to the connector.

Connector Attachment

This process involves assembling a connector to an installed cable or to a device on the site.

Follow these guidelines when attaching the connector.

- Ensure operator is fully aware of the connector assembly method before assembling the connector. Assemble the connector in accordance with its pin map.
- Each connector has a hook to prevent its core positions from being changed.
- Check the corresponding grooves before connecting the connector to another connector.
- Use a weather proof tape at the 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 the cable so that contact failure does not occur at the connector connection due to tension.

Identification Tag Attachment

This process involves attaching a marker cable tie, a nameplate, and a label to both ends of a cable (connections to a connector) to identify the use of the cable and the cabling path.

Follow these guidelines when attaching an identification tag.

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

When connecting the cables, always connect the ground cable first. If a worker contacts the equipment, connects a cable, or performs maintenance without connecting the ground cable, the system can be damaged or the worker may be injured due to static electricity and short circuit.

When performing cable work for the system, proceed with the ground work before any other work to prevent errors occurring due to static electricity and other reasons.

After completing cable installation, unused ports must be capped.

When installing, ensure not to overlap or tangle the cables. In addition, consider future expansion. Install the DC power cable and the data transmission cable away from the AC power cable to prevent electromagnetic induction.

Ensure the work is done by personnel properly trained for the cabling job.

Cabling Diagram

The figure below depicts the different cabling options of the HRU:

Figure 91. Cable Diagram

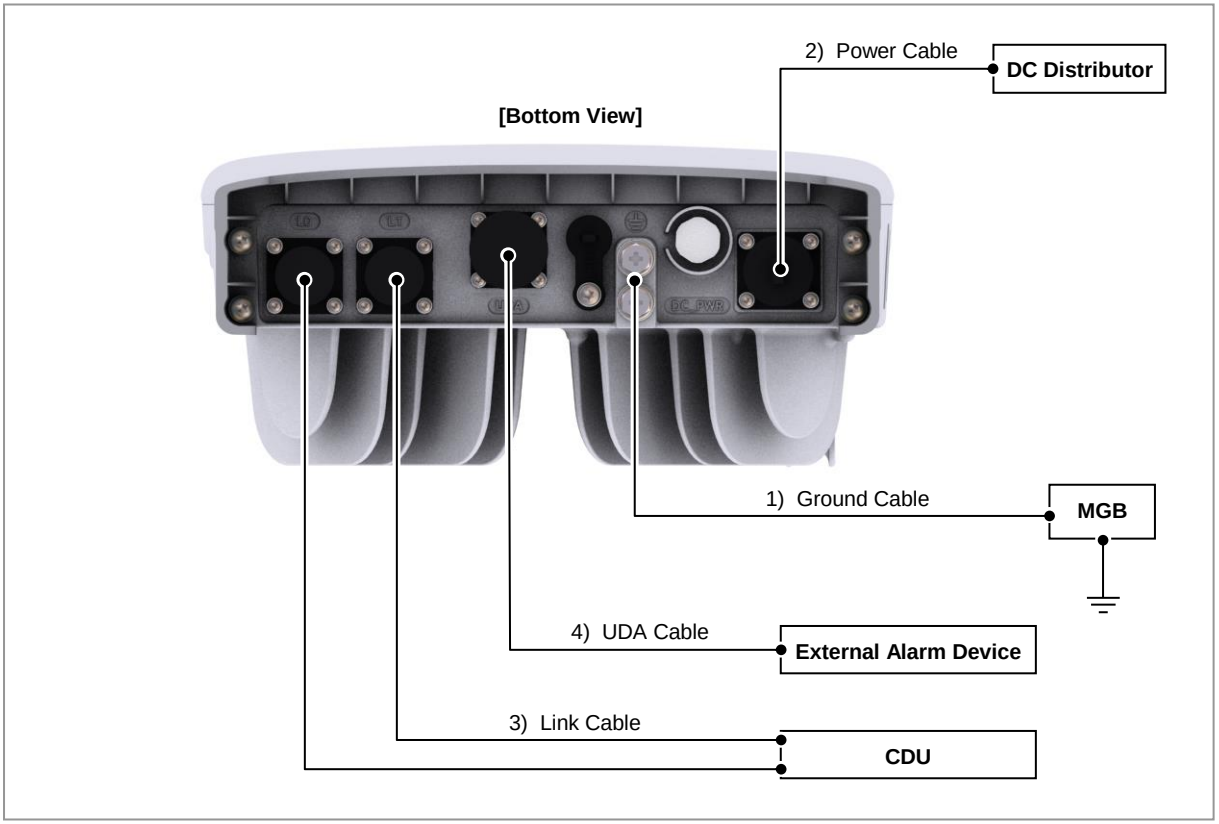


Table 24. HRU Connection Cable

From	To	Cable
MGB	HRU	**1** Ground Cable: 6 AWG × 1C
HRU	Distributor	**2** Power Cable: 12 AWG × 2C
	CDU	**3** Link (Optical) Cable: Single Mode (Single Mode, for Outdoor Type)
	External Alarm Device	**4** UDA Cable: UDA Cable Assembly

The inlet hole finishing method of external equipment must be done after consultation with operation company, if the cable is connected to external equipment, such as optical distribution box.
- Cables: Power cable, Link (Optical) cables, and UDA cable

Grounding

To comply with UL 60950, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly

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

The purposes of the ground construction are as follows:

- To prevent human life and the system from over-current, over-voltage, and lightning.
- To provide a discharge path for surge voltage generated by lightning and power switch.
- To protect the system from static electricity.
- To eliminate or minimize the high-frequency potential in the system housing.
- To provide a conductor for the balance and stability of high-frequency current.
- To stabilize the potential of the circuit against the ground.

Connecting Ground Cable

To connect a ground cable, do the following:

Prerequisites

Before proceeding with connecting the ground cable, make sure that you have the items mentioned in the table below:

Table 25. Parts and Tools for Connecting Ground Cable

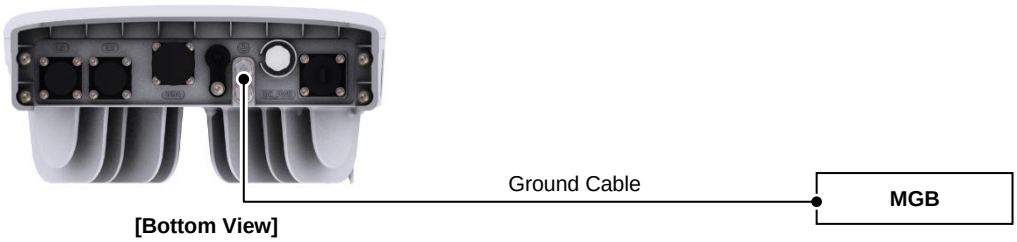
Category	Description	
Installation Section	MGB-HRU Ground Terminal	
Cable	6 AWG × 1C	
Minimum Cable bend Radius	8 × OD	
Heat Shrink Tube (Spec/Color/Length)	Φ 0.47 in. (12 mm)/Clear/1.96 in. (50 mm)	
Pressure Terminal	MGB	Checking MGB specifications per site and preparing connecting parts
	HRU	6 AWG, 2 Hole, Hole diameter: 1/4 in. (6.4 mm), Hole spacing: 0.63 in. (16 mm)
Fastener	MGB	Checking MGB specifications per site and preparing connecting parts

Category	Description	
	HRU	M6 × L12 SEMS (Hex.+)/2 EA
Recommended Torque Value	M6 SEMS	43 lbf·in (50 kgf·cm)
Working Tools	• Cable Cutter • Wire Stripper • Crimping tool • Heating Gun • Nipper • Screw Driver (‘+’, Number 3) • Torque Driver (20 to 90 lbf·in.) • Screw Driver Bit (‘+’, Number 3)	

For the pressure terminals of the cable, the UL listed products or equivalent must be used.
For example, Manufacturer-Panduit
- HRU: 6 AWG Pressure Terminal (LCD6-14AF-L)

1 Install the ground cable from the MGB to the HRU ground terminal, as shown in figure below:

Figure 92. Connecting Ground Cable (1)

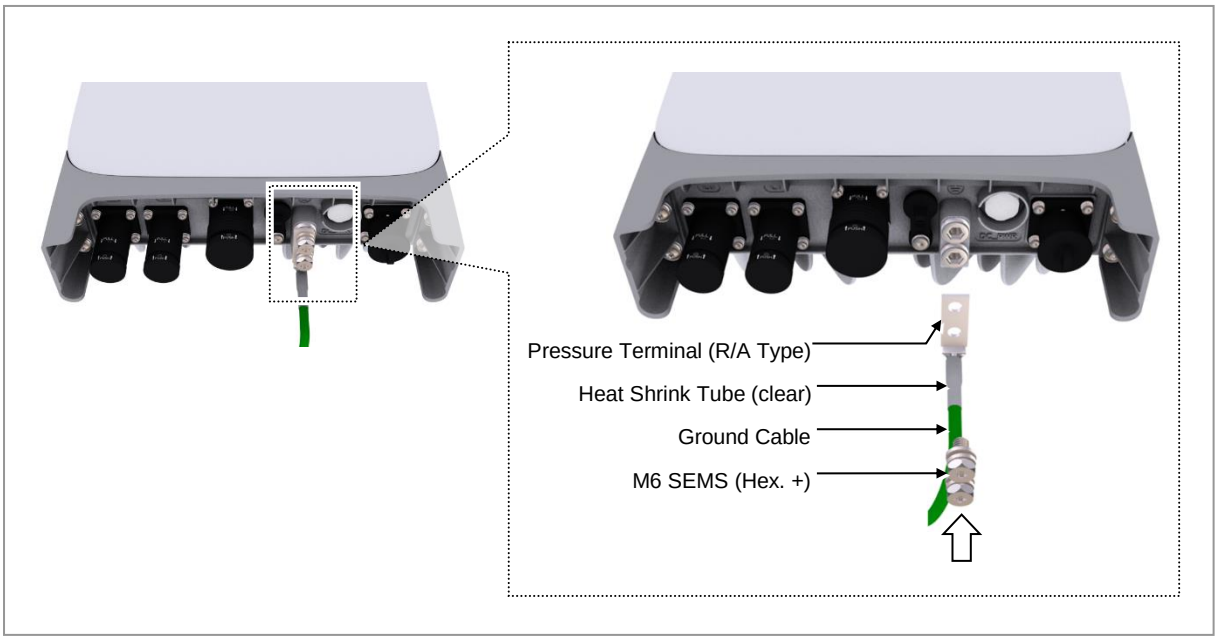


2 Assemble a pressure terminal and a heat shrink tube at the end of the HRU ground cable.

3 Align the pressure terminal to the mounting hole of the HRU ground terminal.

4 Firmly fix the pressure terminal onto the HRU ground terminal using fasteners.

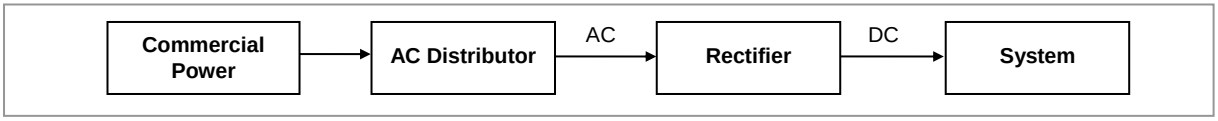
Figure 93. Connecting Ground Cable (2)



Power Cabling

The figure below depicts the elements of a power supply device:

Figure 94. Power Equipment Elements



Since power is applied to the system where the power cable is connected by manipulating the circuit breaker of the rectifier, ensure to check the rectifier breaker is turned off (open) before connecting the power cable to the power connector. If the system is installed while the circuit breaker is on, the worker may get critically injured if the cable is connected in the wrong way.

Handling the power cable incorrectly may damage the rack or cause an electric short-circuit through the cable. Ensure the power switch of the rectifier or the system is turned off before handling the power.

The fasteners for power cable must be tightly secured to prevent electrical accidents.

The heat-resistant temperature of the power cable should be 90℃ or more.

Install the power cable to the power port of the system by considering the radius of curvature of its cable specification and then cut the cable. If the operator installs the cable after cutting, there may be length difference among the core wires at the end of the cable because of cable curvature. This may result in poor contact after the cable is connected to the power port.

If you turn the power on and off rapidly (within 1 s), the counter electromotive force caused by cable inductance can damage the system.

Connecting more than one power cable together may increase power loss.

It must be verified that the rectifier or the power distributor has an output voltage within the specified system input range before the power line is connected.

For a 12 AWG DC power cable, the possible length is up to 43 m (@ DC distribution box for supplying a minimum of 42 V) if the cable installation is normal. When the installation condition changes, the distance changes.

Install a circuit breaker to a rectifier (or power distributor) for the stable power. The capacity of the circuit breaker is 10 A. (Use UL listed circuit breakers.)

Connecting Power Cable

To connect a power cable, do the following:

Prerequisites

Before proceeding with connecting the power cable, make sure that you have the items mentioned in the table below:

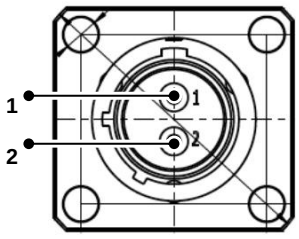
Table 26. Parts and Tools for Connecting Power Cable

Category	Description	
Installation Section	Distributor-HRU power input port	
Cable	12 AWG × 2C (The color of the core wire can be changed according to the specification of the cable used.)	
Minimum Cable bend Radius	8 × OD	
Connector	Distributor	Check specifications of DC distributor output terminal per site and prepare fasteners.
	HRU (DC)	JONHON, DY6T1202SNFM-05 to OPEN
Working Tools	• Cable Cutter • Wire Stripper • Compressor • Heating Gun • Nipper	

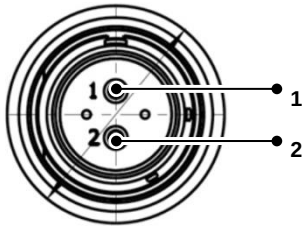
The table below outlines the power cable connector pin map:

Table 27. DC Power Cable/Connector Pin Map

Power Connector Pin Number	Description	Color
Pin 1	-48 V DC	Red
Pin 2	RTN	Black



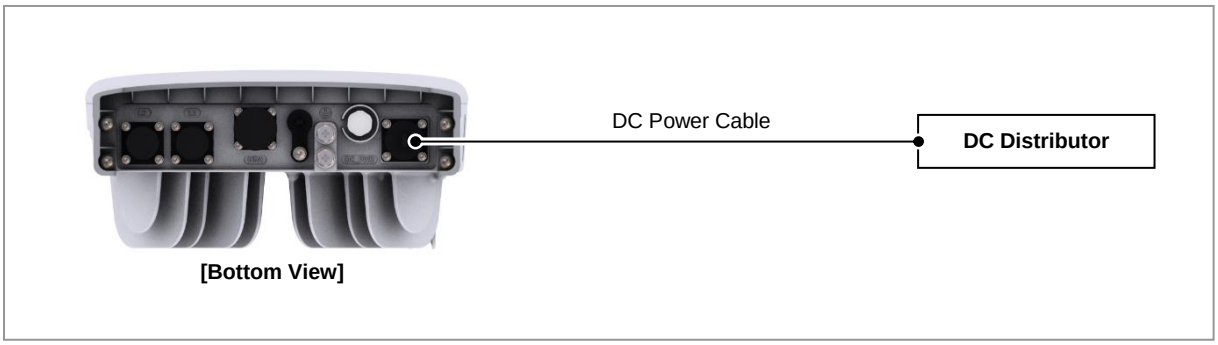
[System side Connector]



[Shell]

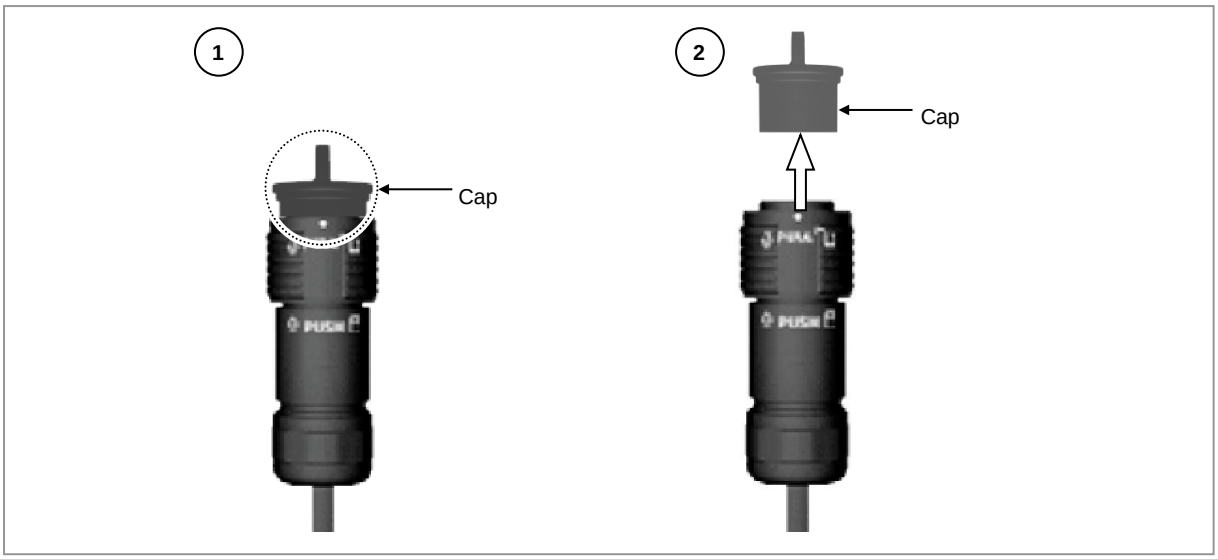
1 Install the power cable from the distributor to the HRU.

Figure 95. Connecting Power Cable (1)



2 Separate the cap from the cable side connector.

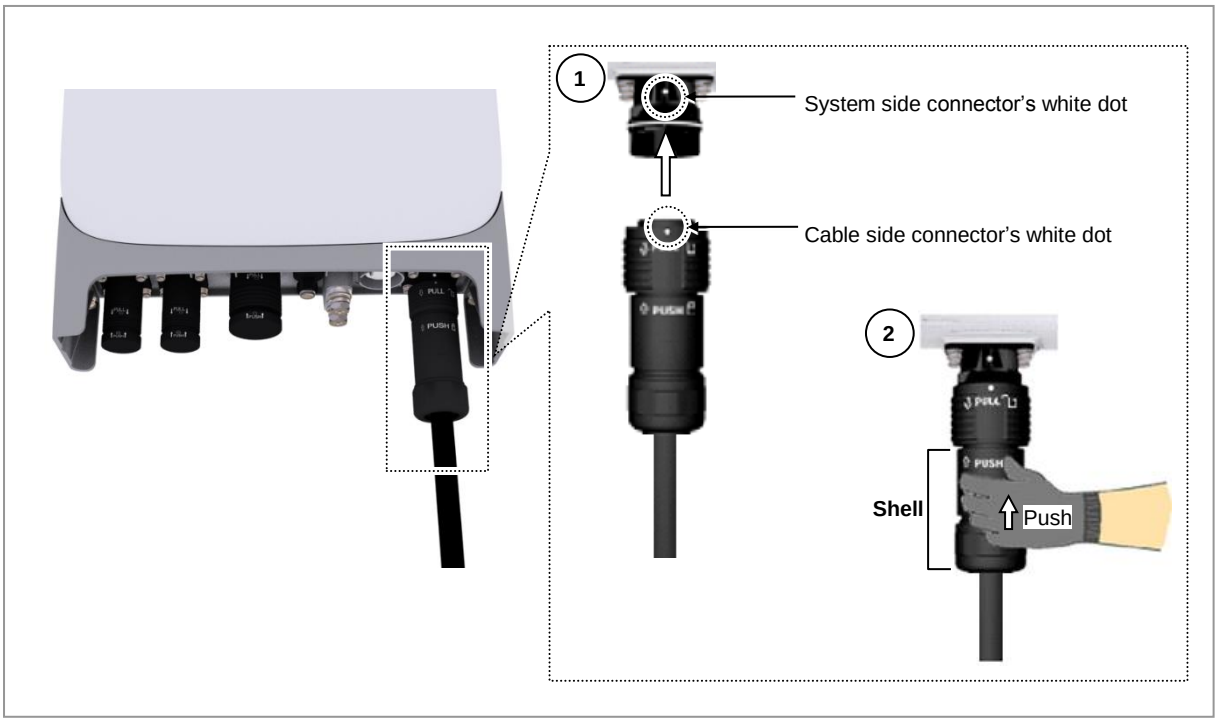
Figure 96. Connecting Power Cable (2)



3 Insert the connector aligning white dot of the cable side connector and white dot of the system side connector.

4 When inserting the connector, push the shell to upper side.

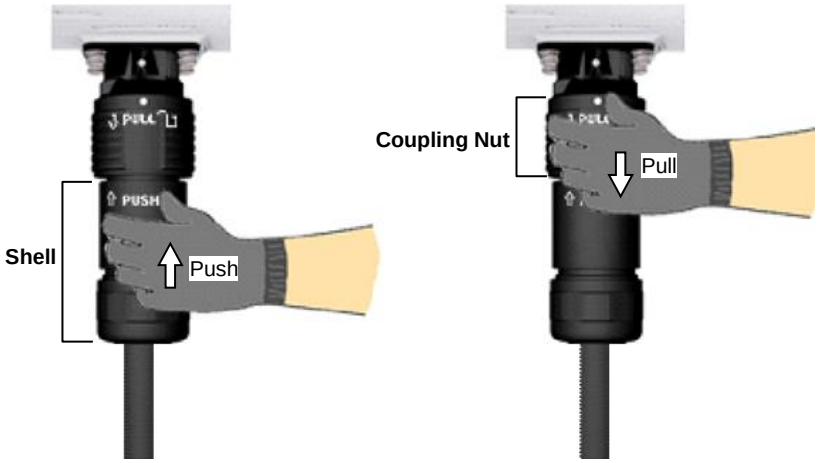
Figure 97. Connecting Power Cable (3)



When the connector is fastened tight, the white line on the system side connector becomes invisible.

[White Line is invisible] **[White Line is visible]**

The method for connecting or disconnecting the power connector is as follows:
- For connecting the connector, push the shell to upper side.
- For disconnecting the connector, pull the coupling nut to lower side.



Interface Cable Connection

This section describes the procedures to connect the interface cables.

Connecting LINK Cable

To connect a LINK cable, do the following:

Prerequisites

Before proceeding with connecting the LINK cable, make sure that you have the items mentioned in the table below:

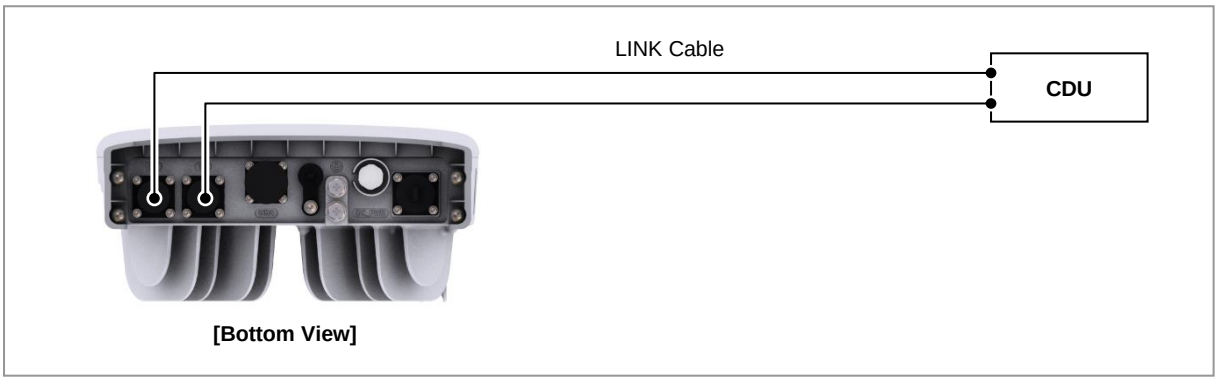
Table 28. Parts and Tools for LINK Cable Connection

Category	Description	
Installation Section	CDU to HRU L0, L1 Port	
Cable	Optical Cable (Single Mode, for Outdoor Type)	
Minimum Cable bend Radius	10 × OD	
Connector	HRU_LINK	MPO [JONHON, PAMPT1AM02-2 Plug]
	CDU	DLC/UPC

The light from the laser beam runs through the optical cable. Handle the optical cables carefully, as the exposure to the laser beam can seriously injure worker's eye.

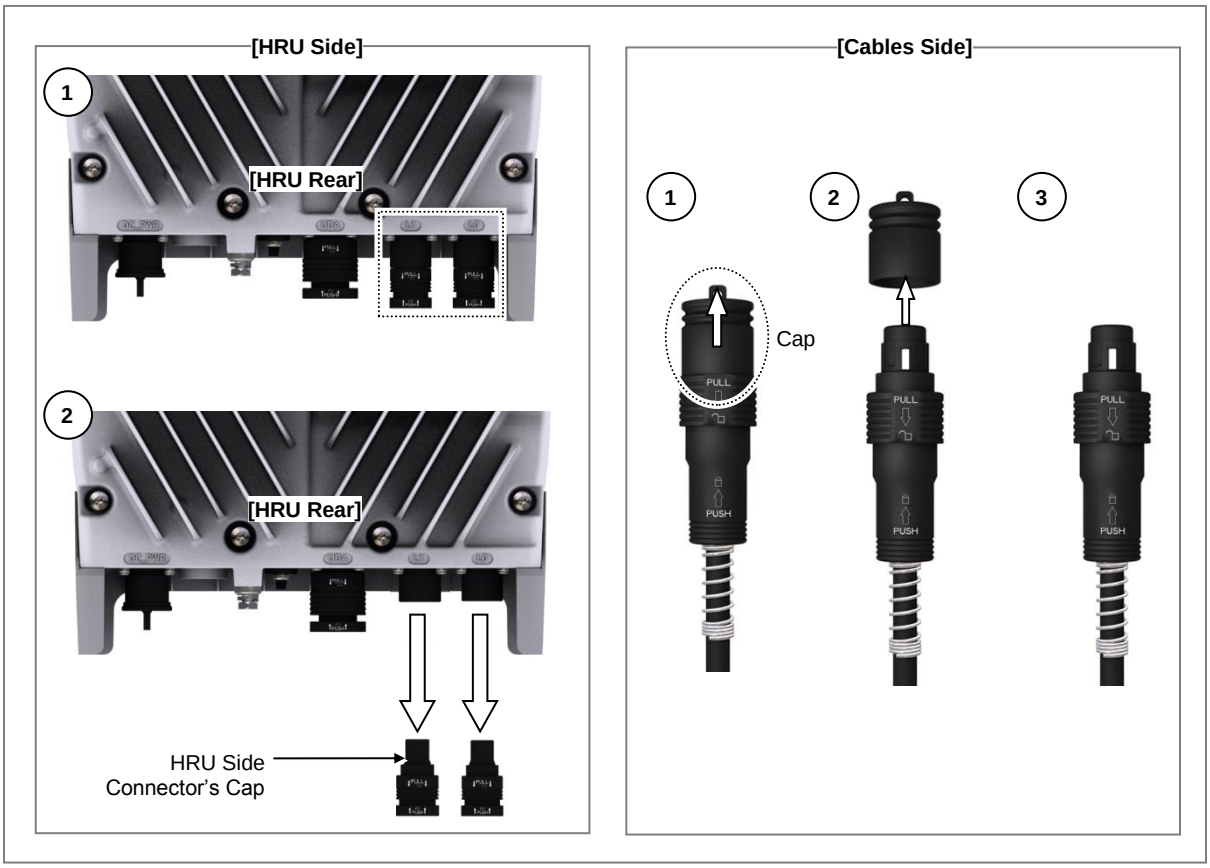
1 Install the LINK cable from the CDU to the HRU L0, L1 port.

Figure 98. Connecting LINK Cable (1)



2 Separate the cap from the HRU/cables side connector.

Figure 99. Connecting LINK Cable (2)

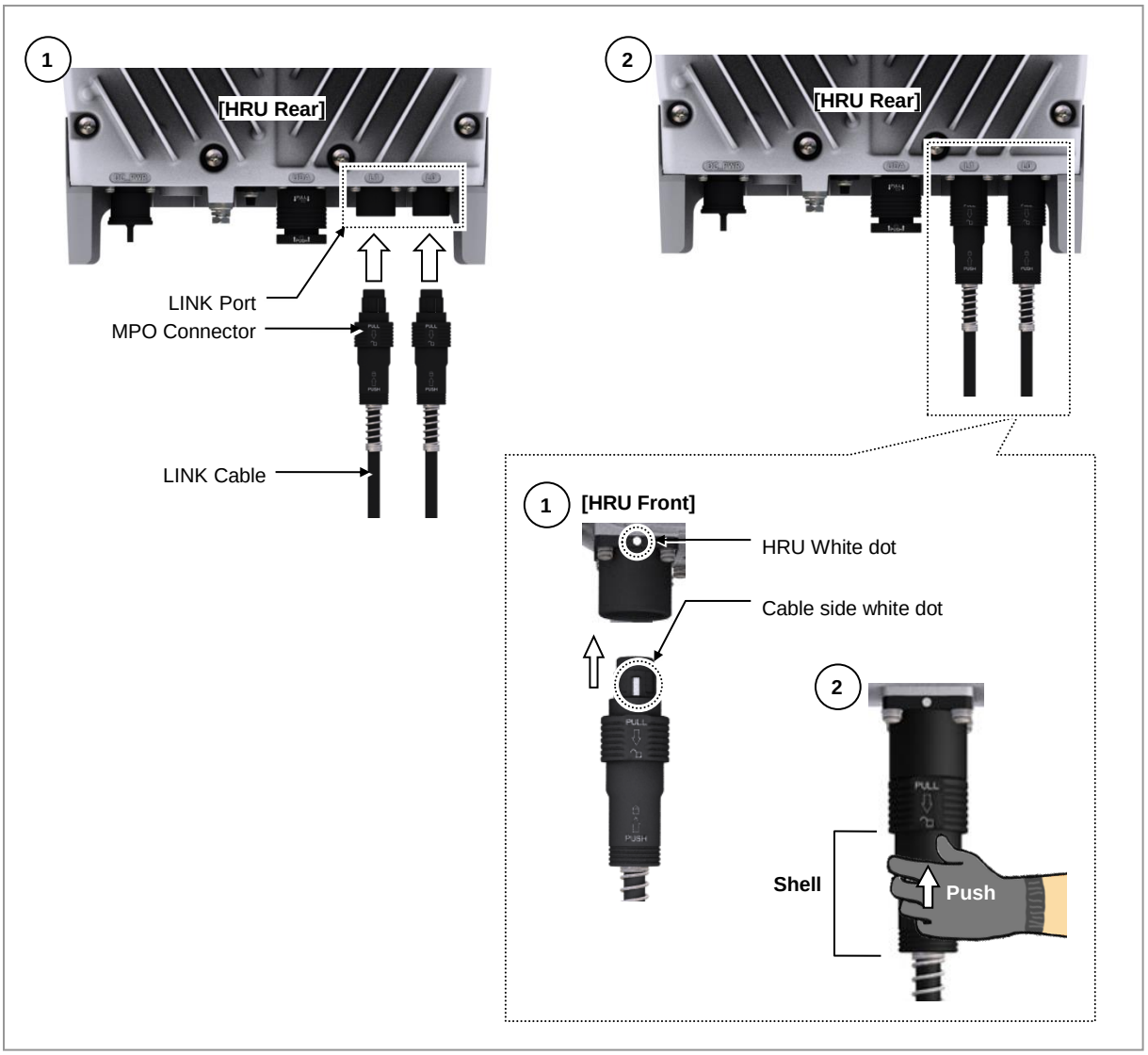


3 Insert the connector aligning the white marking of the cable side connector and the white dot of the system side connector.

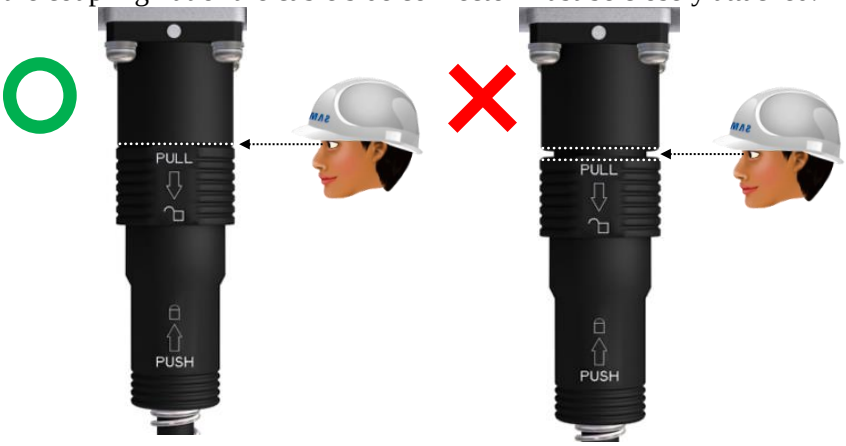
a When inserting the connector, push the shell to upper side.

b Insert the link cable by aligning the white marking of the MPO connector with the white dot of the front link port on the HRU.

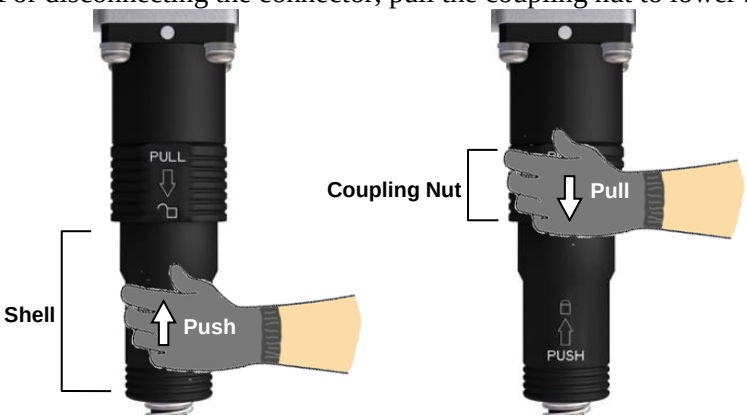
Figure 100. Connecting LINK Cable (3)



When the MPO connector connection is completed, the system side receptacle and the coupling nut of the cable side connector must be closely attached.



The method for connecting/disconnecting the MPO connector is as follows:
- For connecting the connector, push the shell to upper side.
- For disconnecting the connector, pull the coupling nut to lower side.



Connecting UDA Cable

To connect a UDA cable, do the following:

Prerequisites

Before proceeding with connecting the UDA cable, make sure that you have the items mentioned in the table below:

Table 29. Parts and Tools for Connecting UDA Cable

Category	Description	
Installation Section	HRU UDA Port to External alarm device	
Cable	UDA Cable Assembly (24 AWG, 5C)	
Minimum Cable bend Radius	5 × OD	
Connector	External alarm device	Check specifications of external device output terminal per site and prepare fasteners.
	HRU	JONHON, Push Pull Type, RJ45MF-CT-07
Working Tools	• Cable Cutter • Wire Stripper • Nipper • LAN Tool	

The table below outlines the UDA cable pin map:

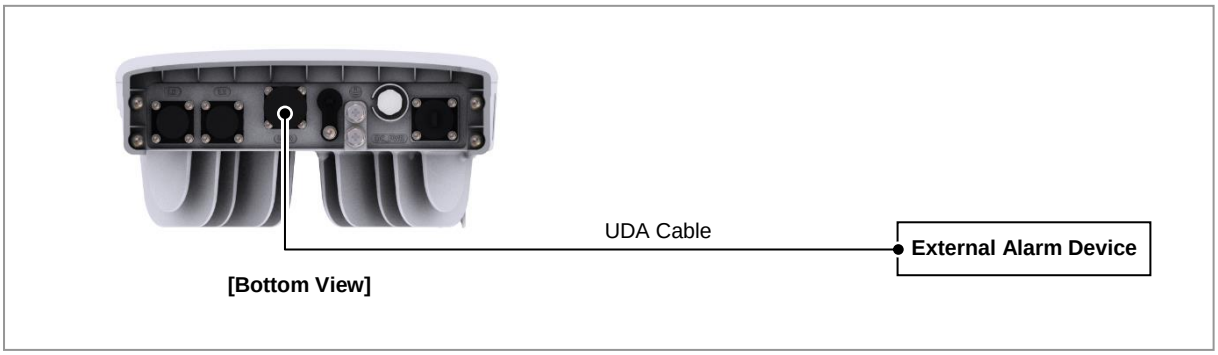
Table 30. UDA Cable Pin Map

System Side	Color Map	Description
1	White/Blue	UDA Common RTN
2	Blue	UDA3
3	Orange	UDA2

System Side	Color Map	Description
4	Green	UDA1
5	Brown	UDA0
6	N.C	N.C
7	N.C	N.C
8	N.C	N.C
Shell	-	-

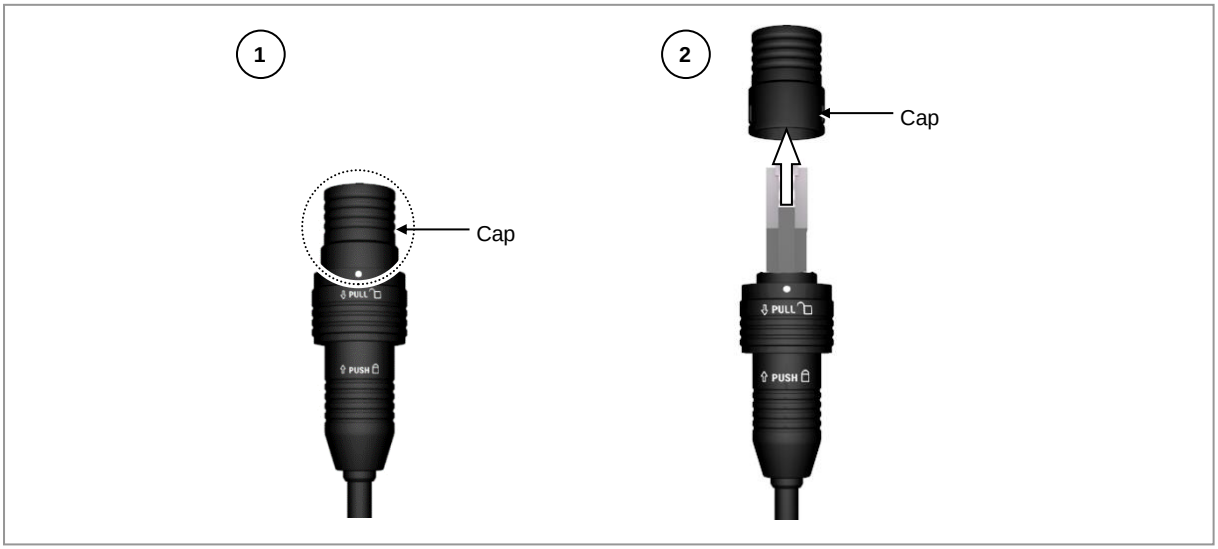
1 Install the UDA cable from the external alarm device to the HRU.

Figure 101. Connecting UDA Cable (1)



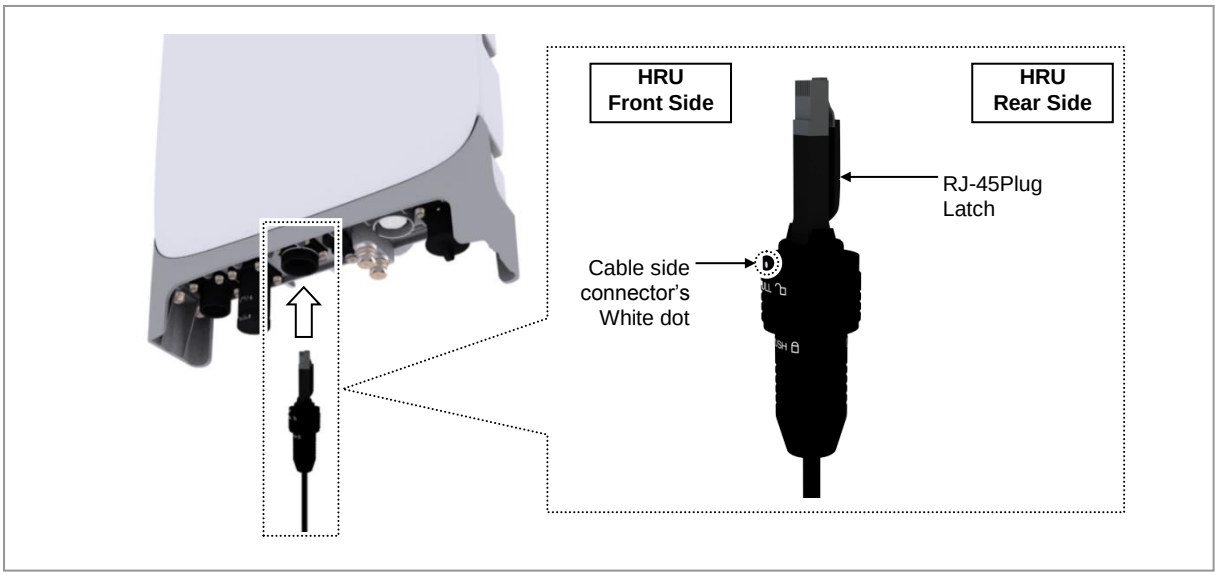
2 Separate the cap from the cable side connector.

Figure 102. Connecting UDA Cable (2)



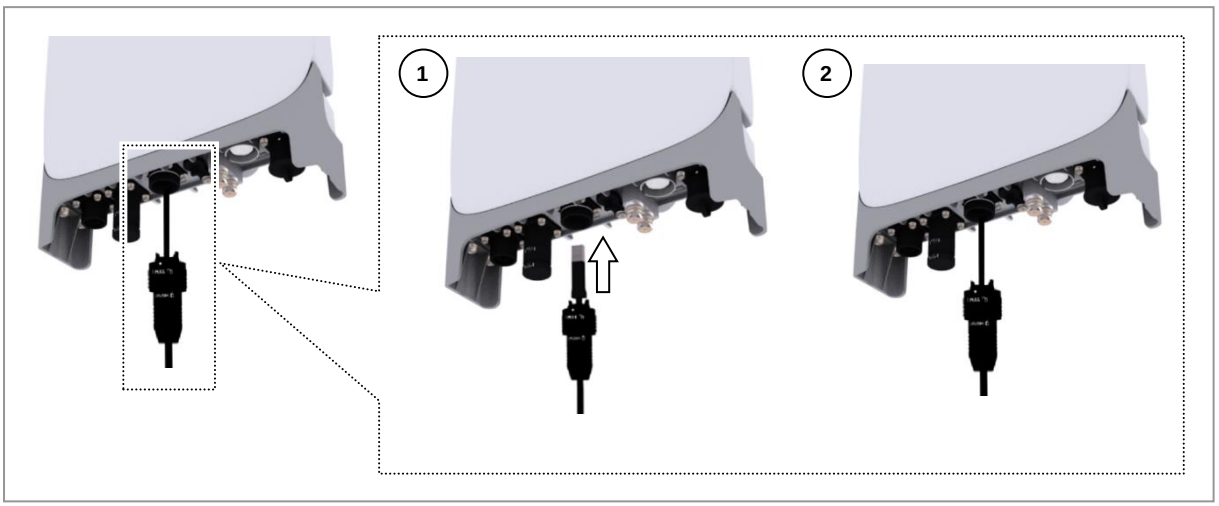
3 The latch of cable side connector should be toward the rear of the system.

Figure 103. Connecting UDA Cable (3)



4 Insert the RJ-45 plug to the system side connector.

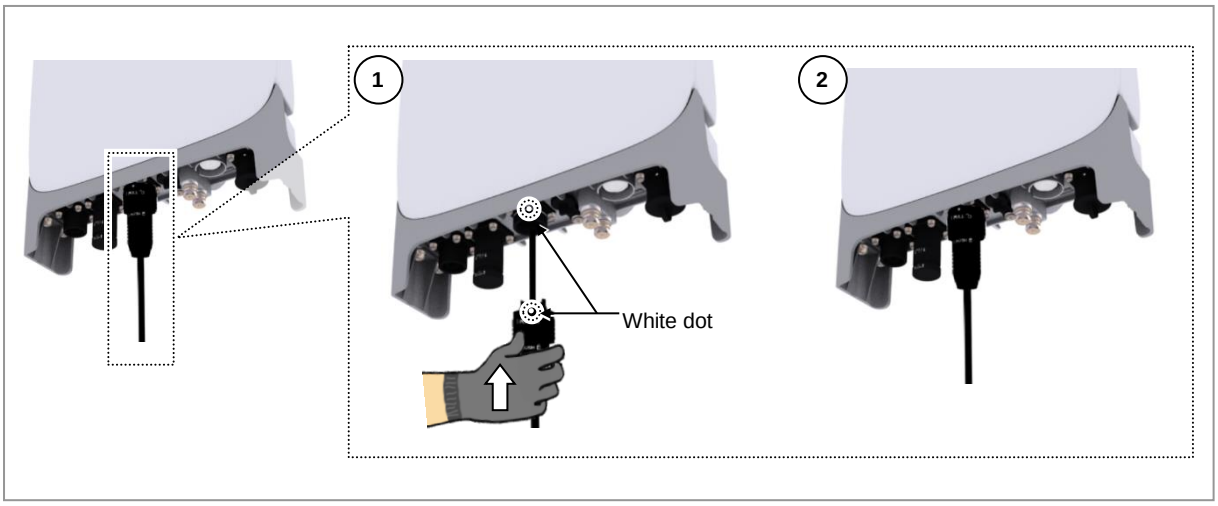
Figure 104. Connecting UDA Cable (4)



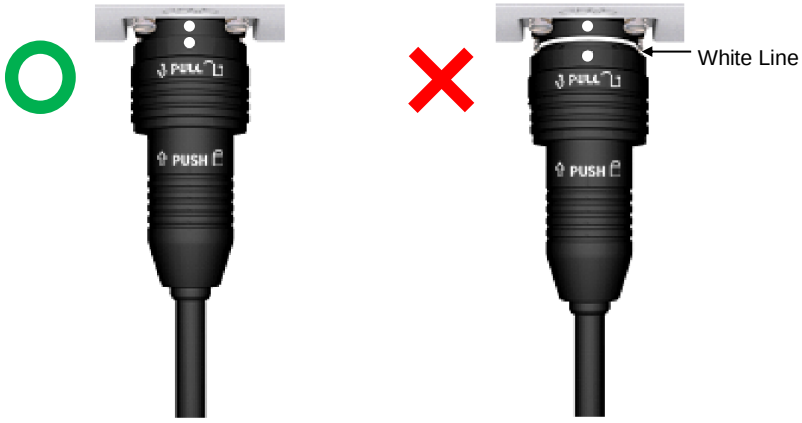
5 Insert the connector aligning white dot of the cable side connector and white dot of the system side connector.

6 When inserting the connector, push the shell to the system side.

Figure 105. Connecting UDA Cable (5)

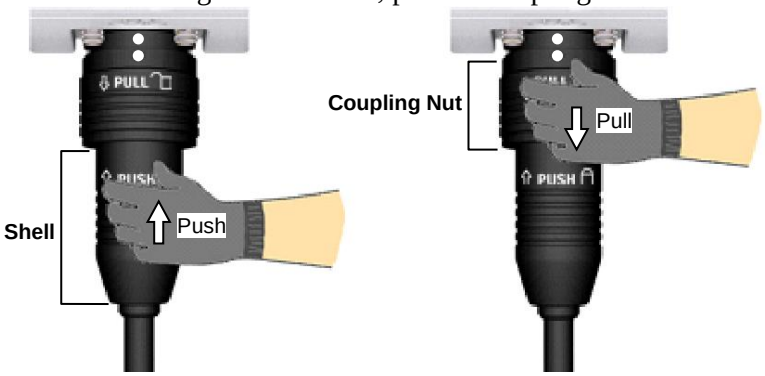


When the connector is fastened tight, the white line on the system side connector becomes invisible.



[White Line is invisible] **[White Line is visible]**

The method for connecting or disconnecting the backhaul (RJ45) connector is as follows:
- For connecting the connector, push the shell to upper side.
- For disconnecting the connector, pull the coupling nut to lower side.

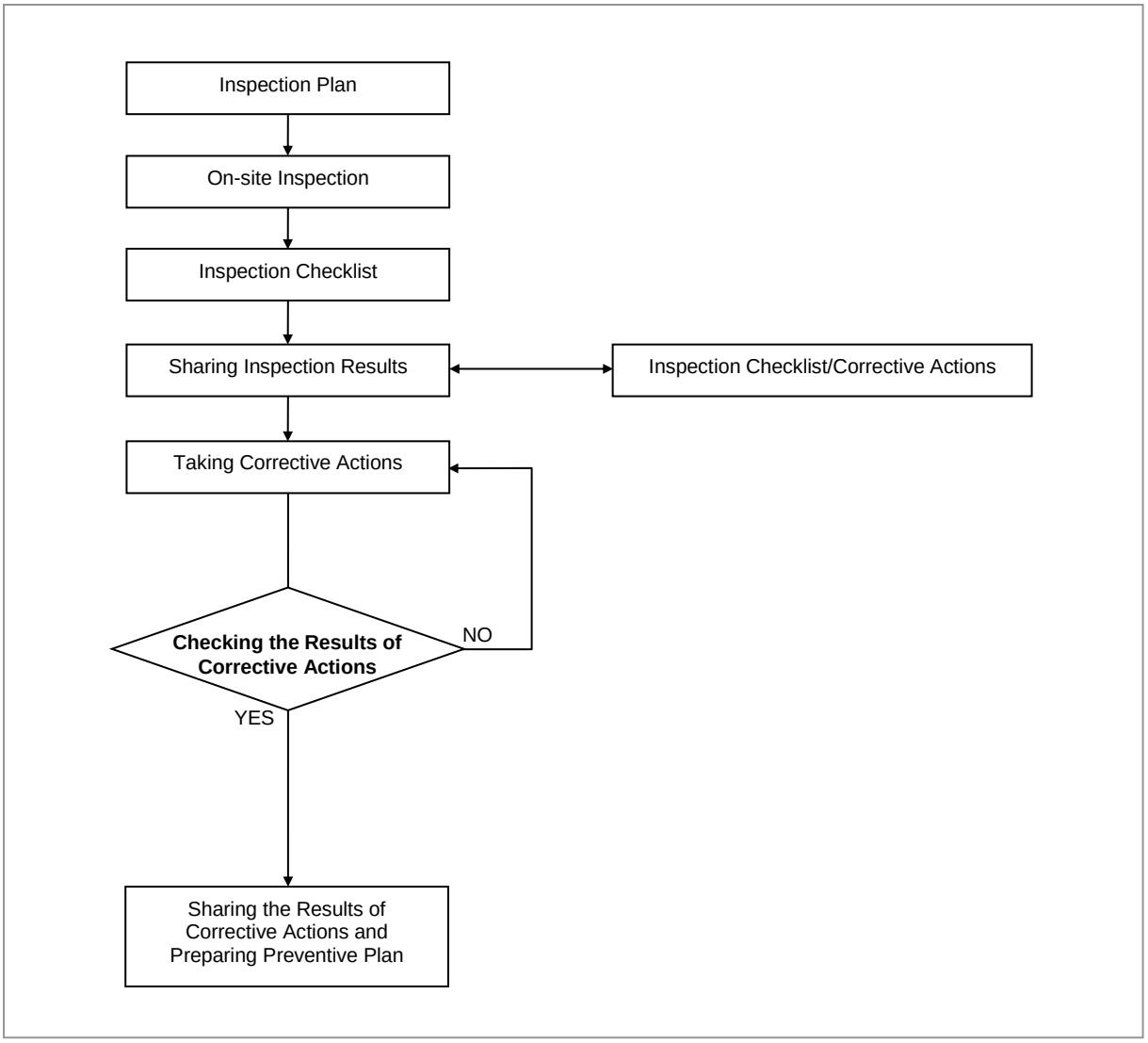


Chapter 4 Inspect the Installation

This chapter describes the procedures to check installation status.

The figure below depicts the overall procedure for inspecting the installation status:

Figure 106. Installation Inspection Procedure



Inspection Plan

Create an inspection sheet per system and select an inspector to set an inspection schedule per site.

On-site Inspection and Inspection Checklist

The on-site inspection is to perform inspection visually or using instruments for each specification, standard, and installation status, based on the inspection checklist at the site where the system is installed.

The inspector must record the results onto the inspection checklist during or after field inspection.

Sharing Inspection Results and Taking Corrective Actions

The inspector must share the inspection results, inspection checklist and corrective actions, with an installation operator. The installation operator must take the corrective actions, if necessary, after reviewing the requirements.

Checking the Results of Corrective Actions

The inspector must check if the corrective actions are properly taken. If they are not sufficient, the inspector must ask the installation operator to take the corrective actions again.

Sharing the Results of Corrective Actions and Preparing Preventive Plan

After the corrective actions are all completed, the inspector must share the results with the installation operator and relevant departments. The inspector must prepare a preventive plan to avoid the reoccurrence of the similar problems.

Construction Situation Checklist

The table below outlines the checklist to inspect the installation of the HRU and other devices.

Table 31. Construction Situation Checklist

Category	Check Items	Criteria	Result	
			Pass	Fail
Installing Equipment	Appearance of equipment and mechanical parts	Equipment damage such as dent, scratch, and crack		
	Placement of equipment and mechanical parts	Maintenance and horizontal/vertical placement		
	Leveling condition of equipment and mechanical parts	Horizontal/vertical status		
	Validity of status and specifications of fastening bolt, nut, and washer	Checking fasteners omission		
		Compliance with assembly order of fasteners		
		Compliance with fastening torque value		
	Insulation status	Checking electrical contact between insulators (insulation resistance tester)		
Grounding	Installation of ground bar	Checking the separation of communication/power/lightning		

Category	Check Items	Criteria	Result	
			Pass	Fail
		grounding		
	Cable specification	Checking the specification		
	Cabling	Cable damage		
		Proper installation route		
		Compliance with the radius of curvature		
	Cable binding status	Binding status		
		Binding interval		
		Checking binding materials		
	Cable connection	Assembly condition of a pressure terminal		
		Fastening condition of a pressure terminal		
		Checking compliance with fastening torque value		
	Installation status of cable tag	Position		
		Marking content		
		Checking tag installation method		
Power	Installation status of power supply	Power supply capacity		
		Output voltage (tester)		
	Installation of circuit breaker	Checking circuit breaker capacity		
	Cable specification	Checking the specification		
		Checking the limit distance		
	Cabling	Cable damage		
		Proper installation route		
		Compliance with the radius of curvature		
	Cable binding status	Binding status		
		Binding interval		
		Checking binding materials		
	Cable connection	Checking cable connection (Pin Map)		
		Input voltage		
		Assembly condition of a pressure terminal and connector		
		Fastening condition of a pressure terminal and connector		
		Checking compliance with fastening torque value		
	Installation status of cable tag	Position		
		Marking content		
		Checking tag installation method		
Other data cables	Cable specification	Checking the specification		
	Cabling	Cable damage		
		Proper installation route		

Category	Check Items	Criteria	Result	
			Pass	Fail
		Compliance with the radius of curvature		
	Cable binding status	Binding status		
		Binding interval		
		Checking binding materials		
	Cable connection	Checking cable connection (Pin Map)		
		Assembly condition of a connector		
		Fastening condition of a connector		
		Checking compliance with fastening torque value		
	Installation status of cable tag	Position		
		Marking content		
		Checking tag installation method		
		Checking tag installation method		
Others	Reserved ports	Checking port cap fastening status		
	Cable inlet status/Connection of equipment I/O port	Checking fastening status (Conduit/Cable Gland)		
	Cable tray and duct	Checking installation status		
	Status of inside/outside of the equipment and system surrounding area	Checking the stocking condition (waste parts, waste materials, and packing materials)		
Opinion				

■

Appendix A Acronyms

AC	Alternating Current
DC	Direct Current
DL	Down Link
HRU	Hybrid Radio Unit
NR	New Radio
MGB	Main Ground Bar
RTN	Return
SELV	Safe Extra Low Voltage
SEMS	pre-asSEMbled washers and screws
S-FTP	Screened-Foiled Twisted Pair
UL	UpLink

Appendix B Clean the Optical Connectors

This chapter describes the procedure to clean the MPO connector.

To clean the MPO connector, do the following:

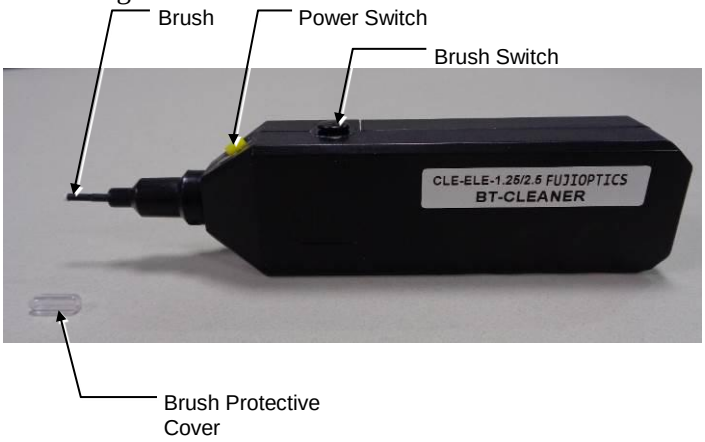
Prerequisites

Before proceeding with cleaning the MPO connector, make sure that you have the items mentioned in the table below:

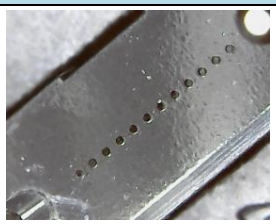
Table 32. MPO Connector Cleaning Tools

Category	Description
Working Tools	• MPO Cleaning Tool (FUJIOPTICS) • Optical Power Meter

The configuration of the MPO cleaner is as follows:

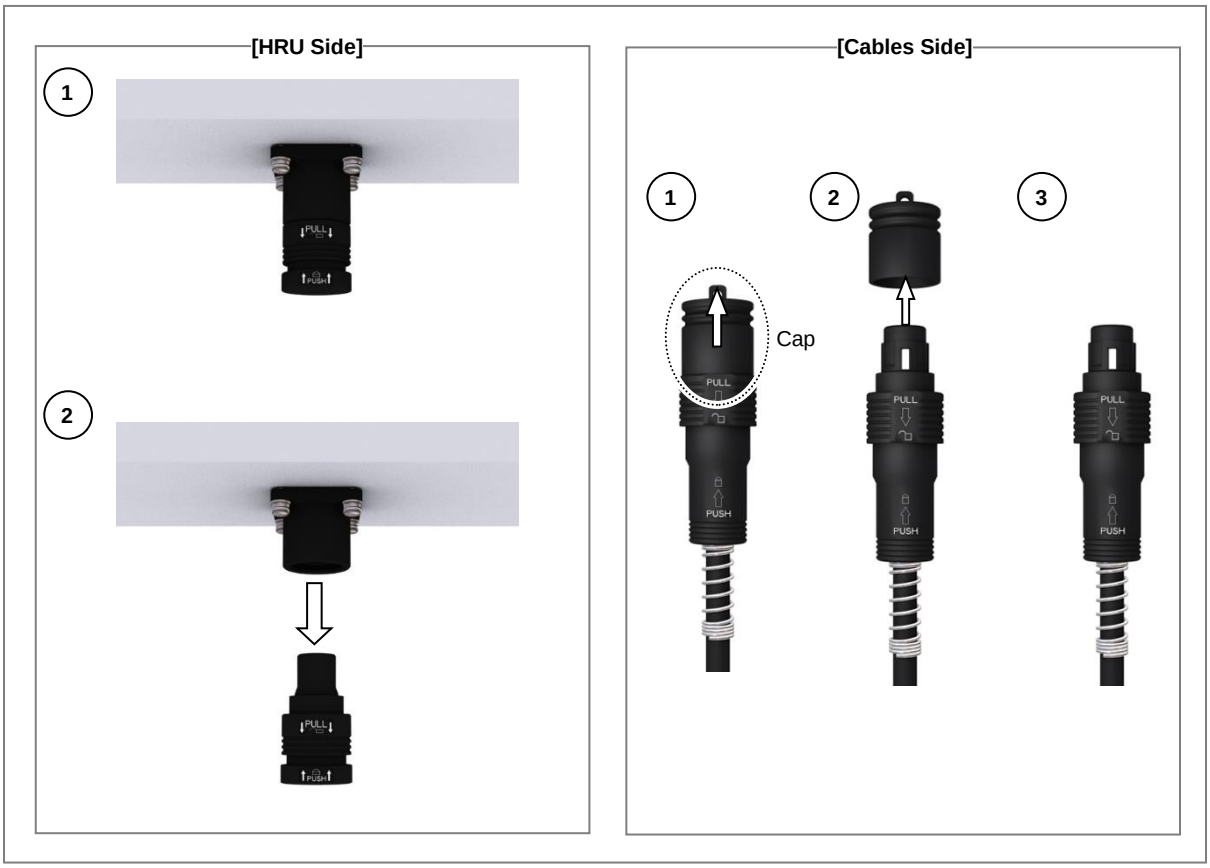


The ferrule can be cleaned using the MPO cleaner as follows.

Before Cleaning MPO Ferrule	After Cleaning MPO Ferrule
	

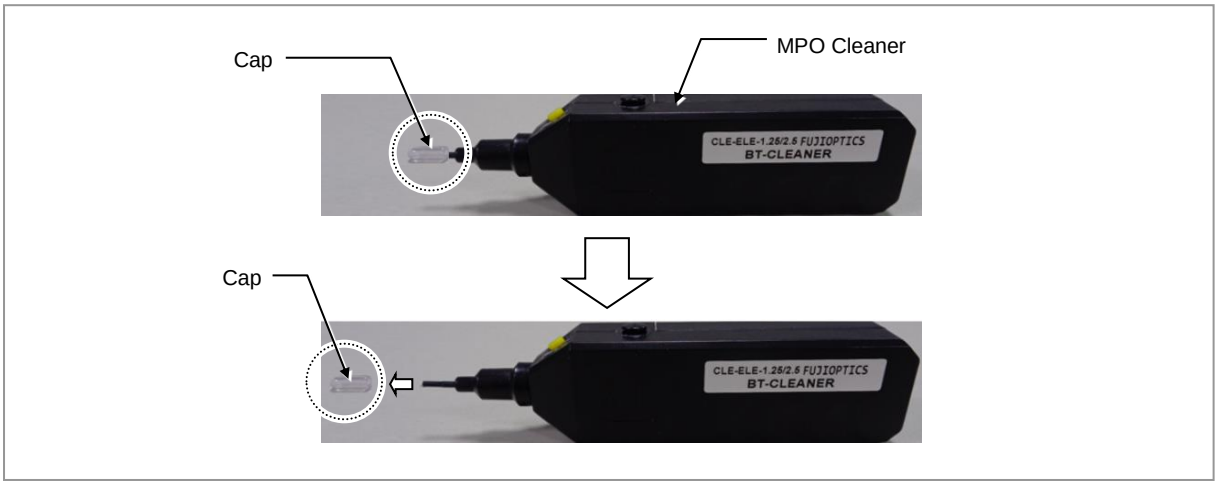
1 Separate the cap from the HRU/cable side connector.

Figure 107. Cleaning MPO Connector (1)



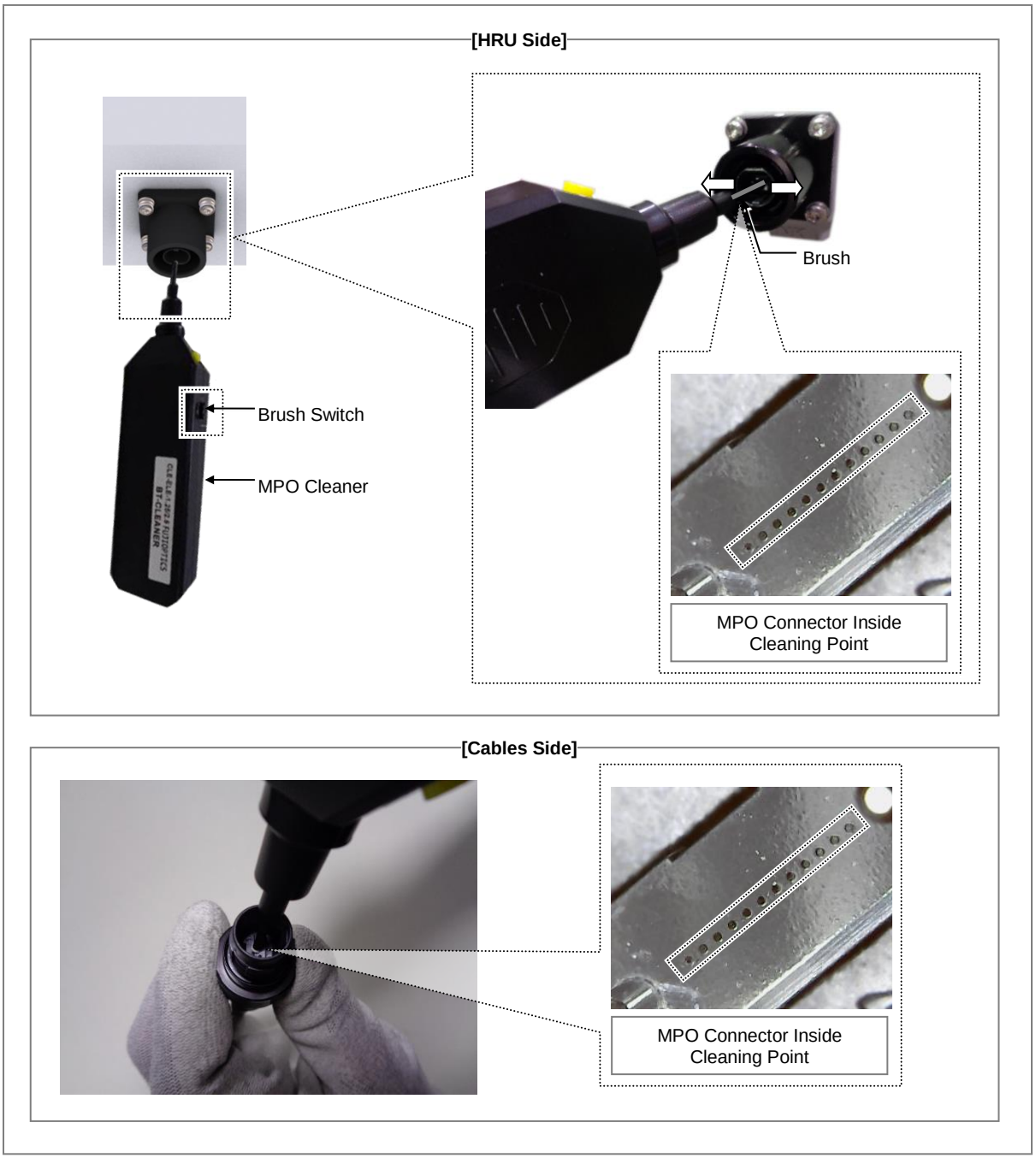
2 Separate the cap from the MPO cleaner.

Figure 108. Cleaning MPO Connector (2)



3 Place the MPO cleaner brush on the cleaning point in the connector on the HRU/cable side and press the brush switch to move the brush left and right to clean the ferrule.

Figure 109. Cleaning MPO Connector (3)



Appendix C Standard Torque

When fastening the bolt, use the standard torque values provided in tables below for tightening nuts and bolts to prevent damage to the equipment. If the torque value for each connection part is predefined, use the defined value.

Table 33. Standard Torque Value for Fastening Bolts

Bolt Spec.	Torque Value (N·m)	Torque Value (lbf·in)	Torque Value (kgf·cm)
M3	0.63	5.6	6.4
M4	1.5	13	15
M5	2.8	25	29
M6	4.9	43	50
M8	12	110	127
M10	25	217	250
M12	42	372	428

Table 34. Brass Bolts Torque Value

Bolt Spec.	Torque Value (N·m)	Torque Value (lbf·in)	Torque Value (kgf·cm)
M6	2.9	26	30
M8	6.3	56	64

Table 35. Connector Connection Torque Value

Connector	Torque Value (N·m)	Torque Value (lbf·in)	Torque Value (kgf·cm)
SMA connector	0.59	5.2	6
TNC connector	0.88	7.8	9
N-type connector	2	17	20
DIN-type connector	25	217	250
4.3-10-type connector	5	44	51

The torque values can be different, defending on the material, characteristic, and specification of the equipment and fastener. Ensure that you check the proper torque value for each specification of the equipment and the fastener.

SAMSUNG

5G NR HRU
Installation Manual

Document Version 1.0