VESTFROST SOLUTIONS

Solar Pole Energy System 4x180Wp



User and installation manual

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1. GENERAL INFORMATION

1.1. INTRODUCTION

- This document provides recommendations for the installation of the Vestfrost Solutions Solar Pole Energy System and identifies some of the hazards associated with the handling and installation.
- Please read this document in its entirety before installing, wiring, or using your solar power system.

Disclaimer of Liability

- Vestfrost Solutions products are designed and manufactured in accordance with relevant international standards. However, as the conditions or methods of installation, operation, use and maintenance are beyond Vestfrost Solutions' control, Vestfrost Solutions does not assume responsibility and expressly disclaims liability for loss, damage or expense arising out of, or in any way connected with, such installation, operation, use or maintenance.
- A warranty claim will be invalidated if there is evidence that the product:
  - has been tampered with, damaged, or something has adhered/been attached to the backsheet
  - has not been installed in accordance with these instructions

1.2. SAFETY AND RELIABILITY

General Safety Information

- These products are intended to operate under normal sunlight conditions, DO NOT attempt to increase module output by concentrating light on its surface.
- Prior to installation, seek guidance from a certified engineer to verify that the mounting arrangement is proper for the conditions of the location.
- The system must comply with all applicable building and electrical codes or regulations.
- The Vestfrost Solutions solar power system may be able to form high temperature arcs if the module, cabling or electrical devices are damaged.
- To minimize fire hazards:
  - For ground mounted installation the design should take into account the growth of vegetation in order to minimize consequent fire risks.
  - System should be designed to allow all means of electrical disconnection to be readily accessible to fire fighters and responders to safety incidents.
  - The solar power system has not been certified for building integration (directly into the roof or wall), marine or vehicle applications. These applications may have additional requirements for which our products have not been certified.

Handling Safety

- Before performing any operation involving the solar power system or system electrical connections, perform a risk assessment paying particular attention to the environmental conditions and personal protection equipment required.
- Use appropriate protective safety equipment as recommended by local safety codes and practices (e.g. hard hat, scaffolding, steel toe-capped shoes, gloves and restraining harness) and exercise caution, particularly when installing the solar power system at height.
- The solar system components are heavy and should always be handled by two people; furthermore, they contain glass, which can be easily broken if mistreated. DO NOT walk on, bend or drop the components. DO NOT place heavy loads or drop objects on the module and ALWAYS keep sharp objects away from the front and back surface.
- DO NOT install the solar power system if any component or glass is damaged because there is an electrical and fire risk. Modules can get very high temperatures when they are in operation and

especially if they are partially shaded; be careful not to touch them without proper personal protection equipment.

Electrical Safety

- The modules can produce current and voltage when exposed to light of any intensity. Electrical current increases with higher light intensity. De-energize the photovoltaic modules by removing them entirely from light or by covering their front surface with an opaque material. Observe the safety regulations for live electrical equipment when working with modules that are exposed to any light. Use insulated tools and do not wear metallic jewelry while working with photovoltaic modules. Potentially lethal voltages can be present when more than two modules are connected in series.
- The installation and wiring of the solar power system should always be performed by an electrical installer who is qualified in accordance with ALL local standards and codes.
- When working with photovoltaic modules, the following precautions must be taken;
  - Ensure that appropriate barriers (fences etc.) are installed to prevent interference or accidental contact with live circuit elements by unauthorized personnel or animals.
  - Disconnect the electrical circuit before disconnecting module cables.

  DO NOT
  - Scratch or mishandle the product,
  - Damage, pull, bend or place heavy loads on the cables.
  - Connect cables when the terminals are wet.
  - Attempt any installation in adverse weather conditions (high winds, rain or when ice or snow are present).

Lightning protection

- The modules are equipped with a lightning protection set.
- All installation and maintenance work on the lightning protection should always be performed by an electrical installer who is qualified in accordance with ALL local standards and codes.

1.3. LOCATION

- Note the following statements before performing the mechanical installation of the solar power system.
- Ensure that there are no objects behind the module that can damage the backsheet when it deflects under normal operating conditions
- The amount of energy produced by the solar power system is dependent upon the incident sunlight and the temperature of the solar cells.
  Best performance will be obtained by:
- Ensuring adequate space behind the modules, allowing proper ventilation.
- Installing the modules at an angle of at least 10° from the horizontal to aid self-cleaning and reduce dirt collection.
- **Ensuring that the modules are not shaded at any time of the day**.
- The solar power system may be operated in ambient temperature between -40°C and 85°C; check if there are nearby heat sources that can create higher temperatures.

Foundation

- A geotechnical investigation must be performed by professionals before installation.
  - The results must show that the ground is suitable for the foundation described in this manual
- Groundwater must be below foundation level.

1.4. OPERATION AND MAINTENANCE

- The system is designed to be collapsible, what offers the option for bringing down the panels in case of service/cleaning or the event of hurricanes arising.
- The structure will be delivered in materials according specifications, anodized aluminum and hot dip galvanized steel ISO 1461.
- In order to maximize system performance, ensure long lifetime and minimize risks, periodic maintenance must be carried out by qualified personnel.
- This maintenance must include but it is not limited to:
  - Due to vibration caused by the wind, bolted connections must be inspected and retightened if necessary. This must be done at least every 2 years and before raising after hurricanes.
  - If the installation is in the open field, periodically clear the vegetation or any other flammable material in the area.
  - It is also recommended to periodically confirm the system installation,
    - verification of the integrity of electrical and mechanical connections,
    - cleaning of the panels (if required).
    - In extremely dry conditions increase visual inspection frequency.
    - Ensure that appropriate barriers (fences etc.) are adequately installed to prevent interference or accidental contact with live circuit elements by unauthorized personnel or animals.
    - Disconnect the electrical circuit before disconnecting module cables.

Module Cleaning

- The energy output of the solar power system can be impaired if the glass is dirty. Cleaning the modules periodically will ensure maximum output. However, if modules are installed at height then this should only be performed by competent personnel
- When cleaning the modules take the following precautions:
  - Clean the module surface with a soft cloth or sponge using clean and neutral water-based cleaners (do not use ammonia or basic solutions with a pH above 7.5).
  - Only clean modules when there is low solar radiation and cells are producing low energy.
  - DO NOT use high-pressurized water, steam cleaners or any kind of aggressive tool or material that could scratch the surface coating on the glass.

1.5. END OF LIFE AND DISPOSAL

- This product must be disposed of in accordance with all applicable local, state, and national laws and regulations. It is the responsibility of the user to ensure that this product is disposed of properly.
- Please contact Vestfrost Solutions if you have any questions concerning the proper disposal of this product.

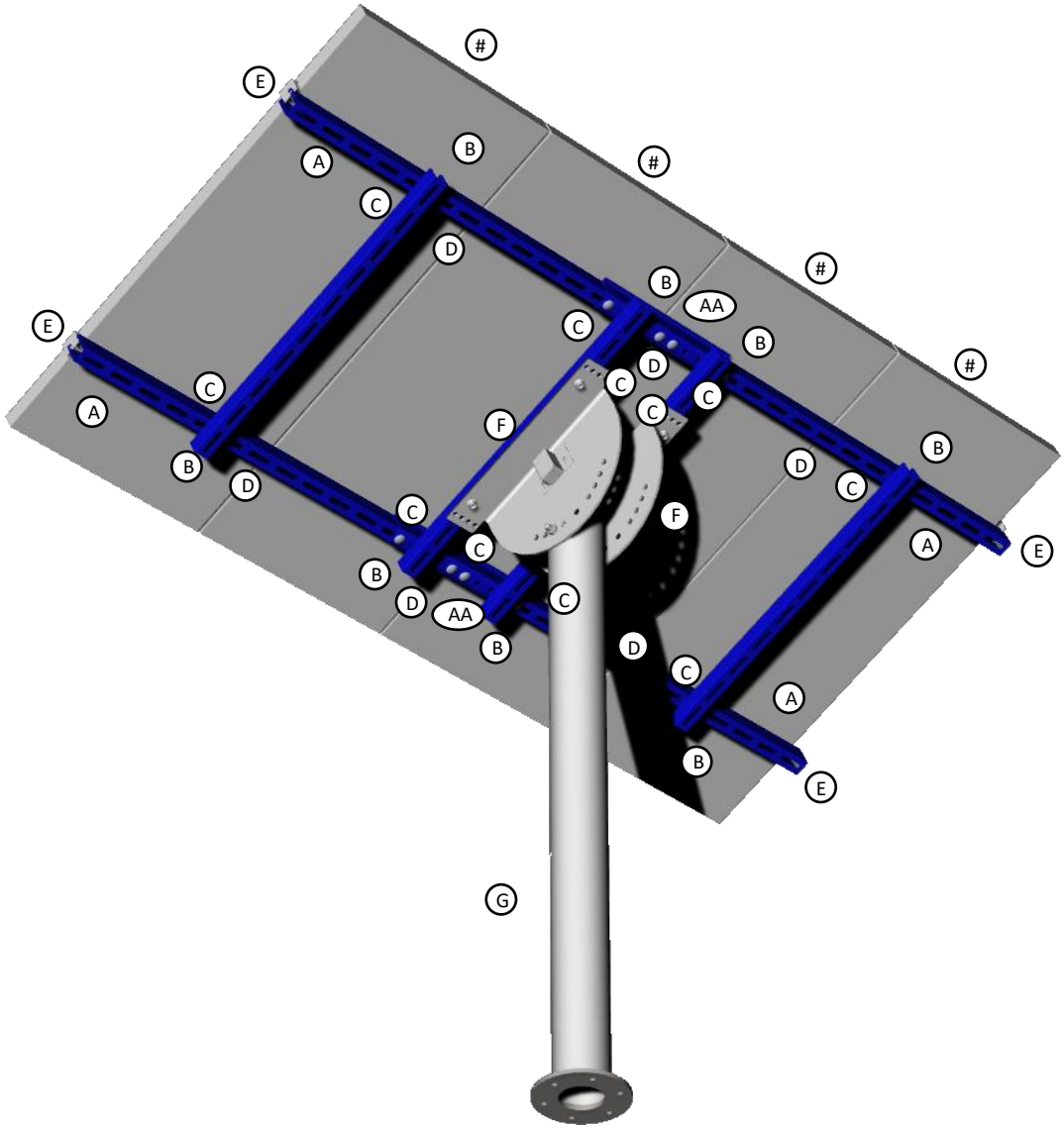
1.6. REQUIRED TOOLS FOR INSTALLATION

- The following tools are needed for the installation of the solar power system.
  - Shovel
  - Pincer
  - 8mm spanner
  - 17mm spanner
  - 18mm spanner and socket wrench
  - Spanner and/or socket wrench for M12 nut and bolts
  - Spanner and/or socket wrench for M16 nut and bolts
  - Adequate lifting material – e.g. rope, pole support (see annex 1)

2. SOLAR POLE ENERGY SYSTEM

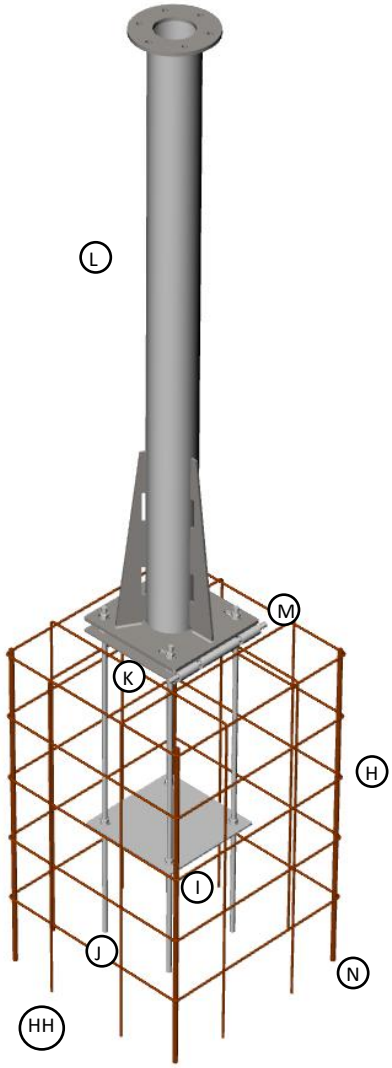
2.1. SCOPE OF DELIVERY – POLE MOUNT

2.1.1. Top assembly



Item	Description	Quantity
#	PV-module – 180 Watt, 1482x676mm	4
A	Mounting rail long – 1397mm	4
AA	Rail connector	2
B	Mounting rail short – 1002mm	4
C	Cross rail connector	12
D	Middle clamp	6
E	End clamp	4
F	Pole bracket	2
G	Pole top – Ø152.4mm with Ø260 flange	1

2.1.2. Bottom assembly



Item	Description	Quantity
H	Reinforcement brace – 700x700 Ø8	5
HH	Reinforcement U-brace – 1160x716 Ø8	4
I	Anchor plate – 350x350x6mm	1
J	M16x1200mm threaded bar	4
K	Casting plate – 370x350x6mm with bushings	1
L	Pole bottom – Ø152.4mm w/ Ø260 flange and tilt plate w/ bushing	1
M	M16x400mm threaded bar	1
N	Ø12x1160 Reinforcement bar	4

2.2. INSTALLATION – Bottom assembly

2.2.1. Foundation

1) Reinforcement basket for foundation

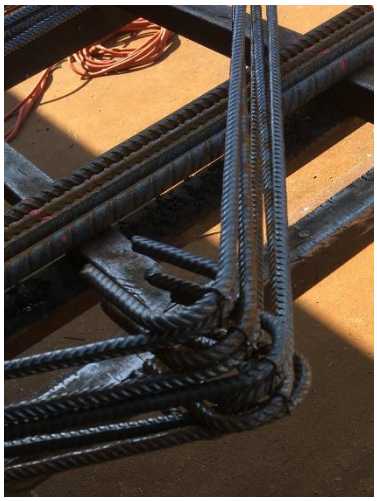
Assemble the reinforcement basket for the foundation, by tying together the reinforcement braces (H / HH) and reinforcement bars (N) as shown below.

Caution:



- Wear protective gloves when handling reinforcement basket.

Tie together the ends of each reinforcement brace (H) and place in a pile
Cut off 75 strings of the thin wire (10-12 cm)

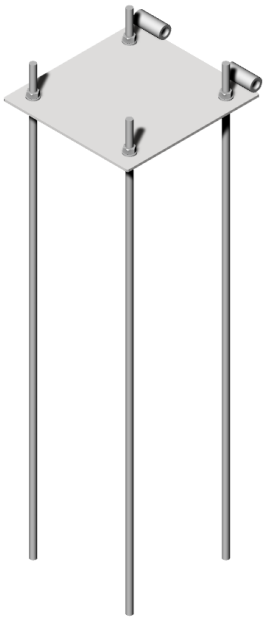
Place a reinforcement bar (N) in each corner of the braces (H). Raise the reinforcement braces one at a time and tie a string around each intersection – distribute the braces (H) evenly along the bars (N). When the frame is tied together, place the reinforcement U-braces (HH) on top of the assembly as shown below – the center square should be approx. 270x270mm to fit the anchor – see below. Finally tie a long string diagonally as shown below to make the basket rigid.

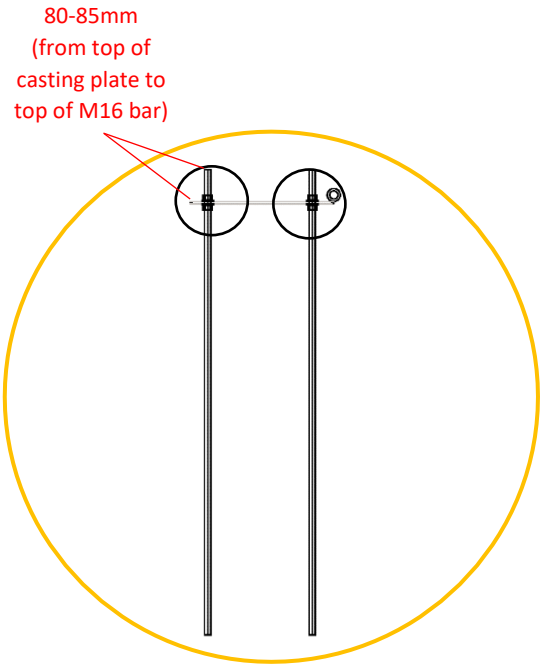


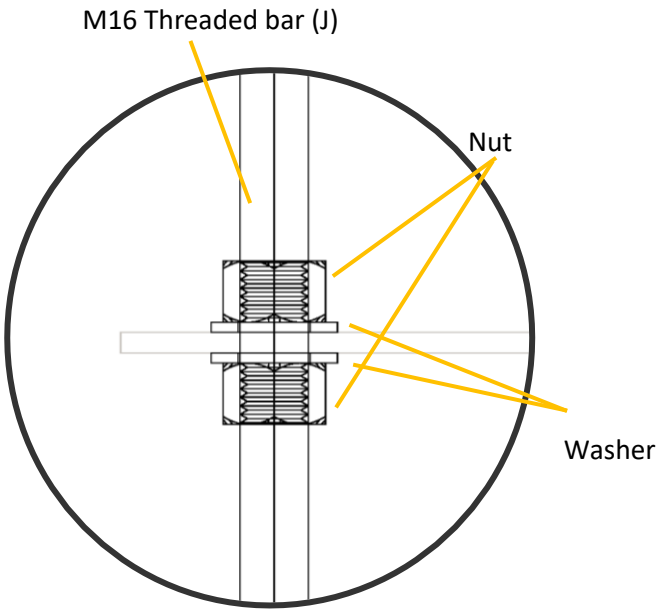


2) Anchoring for foundation

Assemble the casting plate (K) and the M16 threaded bars (J) using washers and nuts as shown below.

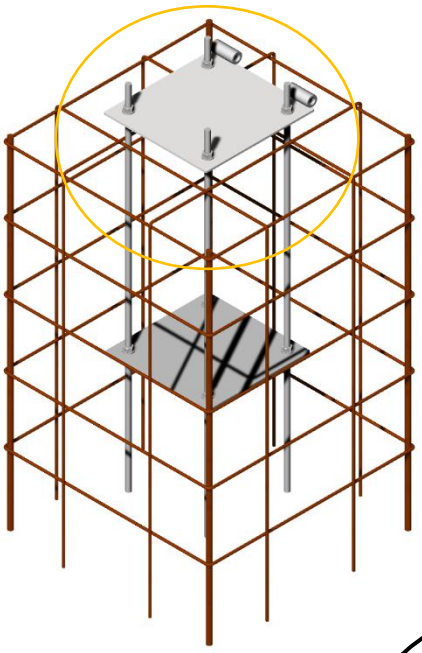


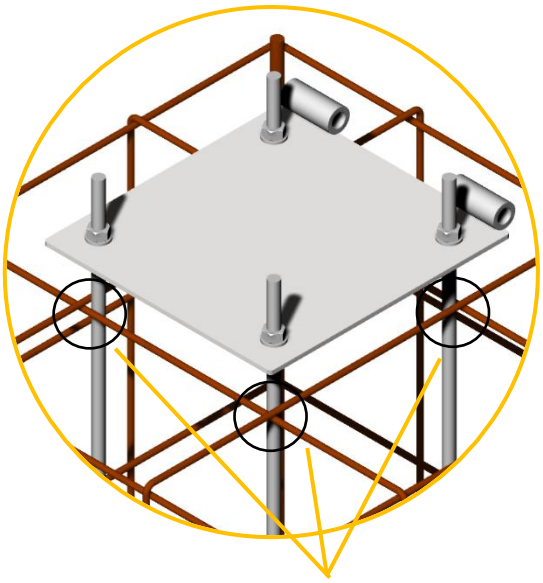




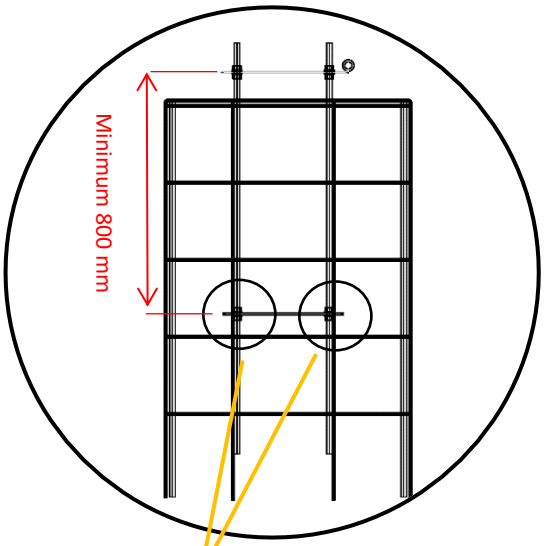
3) Assemble Anchor and Basket

Place the assembly on the basket, with threaded bars (J) through the basket and tie the threaded bars (J) to the U-braces (HH). Finally assemble the Anchor plate (I) to the threaded bars (J) using nuts and washers as shown below.





Tie treaded bars to U-braces using the 10-12cm strings



Assemble anchor plate to treaded bars as shown on previous page

4) Prepare for foundation

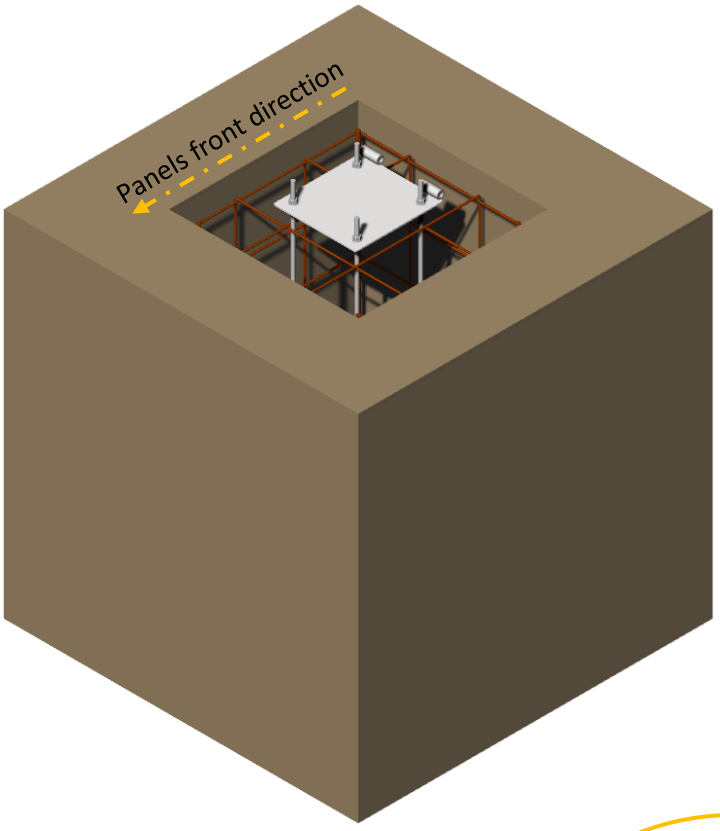
The hole must have the following minimum dimensions (L x W x D) 1000mm x 1000mm x 1200mm.

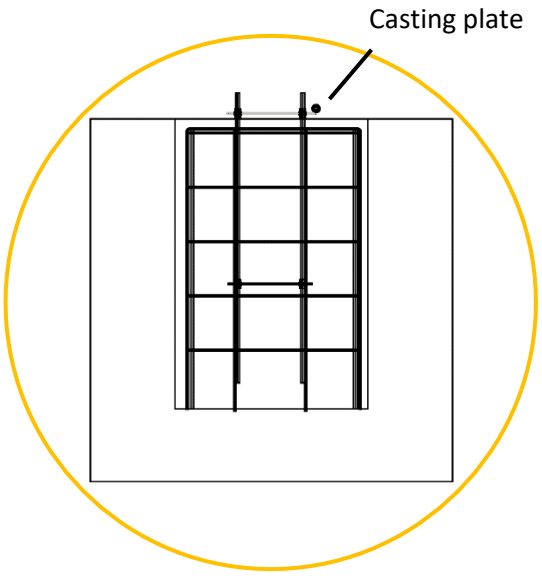
Once the hole has been dug, place the reinforcement basket in the center of the hole as shown below. Place the basket in the hole with the casting plate upwards.

Note: Make sure that the casting plate is oriented, so the solar panels are oriented as following:

- For the northern Hemisphere, the panels should be oriented with the front facing south.
- For the southern hemisphere, the panels should be oriented with the front facing north.

For example, use the Solar Pathfinder to find the optimal position and orientation, or one of the following apps for smartphones: “PV Optimizer & Solar compass” or “EPiSunTools APK”.





5) Casting of foundation

The foundation must be made of steel reinforced concrete (C25 classification). The surface is performed with a slope, minimum 1:20 from middle and outwards as shown below.

Note: Make sure the anchor plate and casting plate is level and at correct height. Also make sure that the M16 threaded bars have enough free of the concrete. While the concrete is curing place the casting plate as high as possible on the threaded bars.

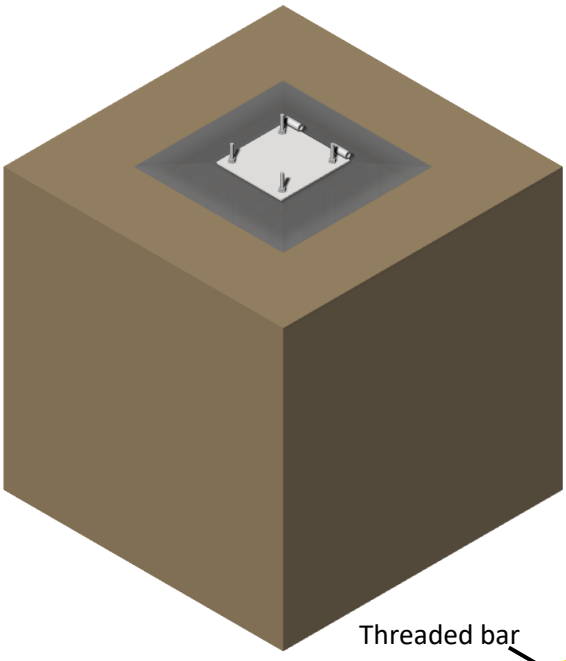


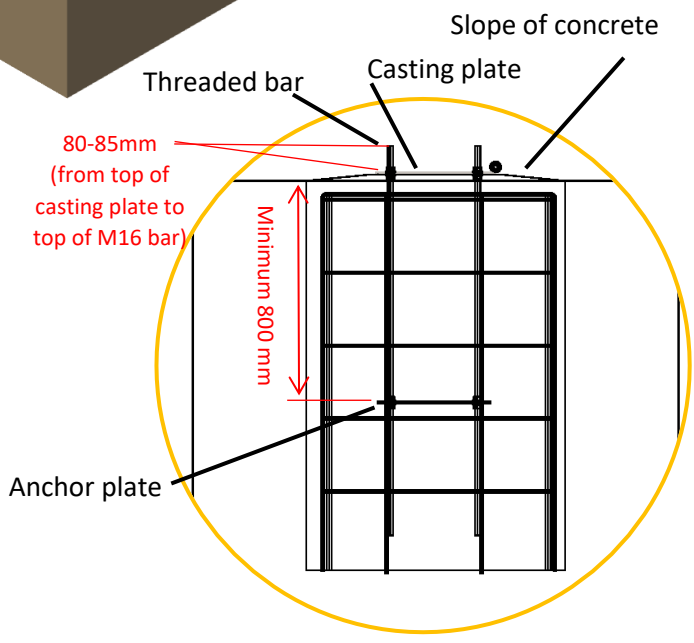




Caution:

- Wear an N, R, or P95 mask when pouring and mixing concrete
- Wear eye protection and protective gloves when handling concrete
- Make sure that the concrete mixture is correct
- Curing time must be according to regional conditions
  (e.g. 80% in 3 days at average temperature = 20°C)
- Direct sun must be avoided – cover the concrete with e.g. plastic cover



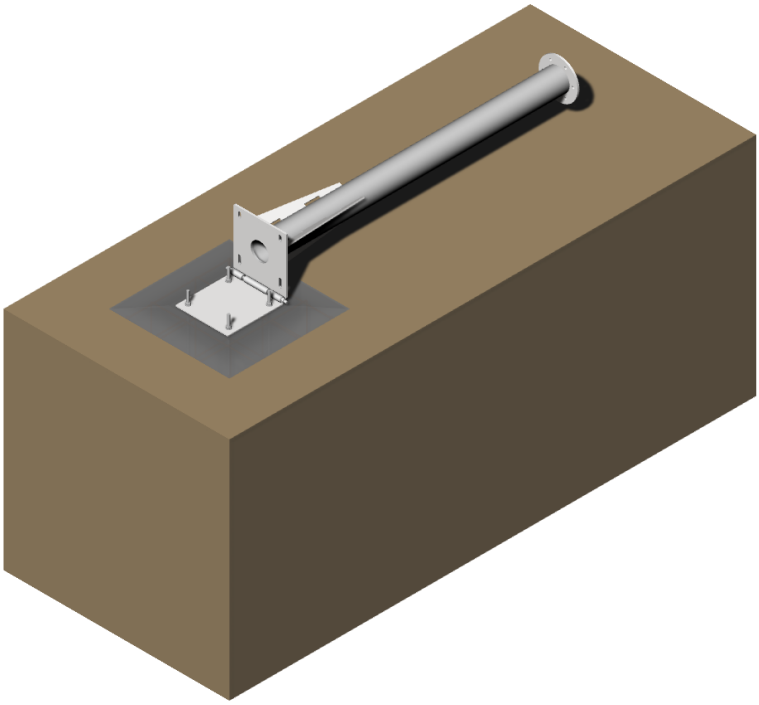


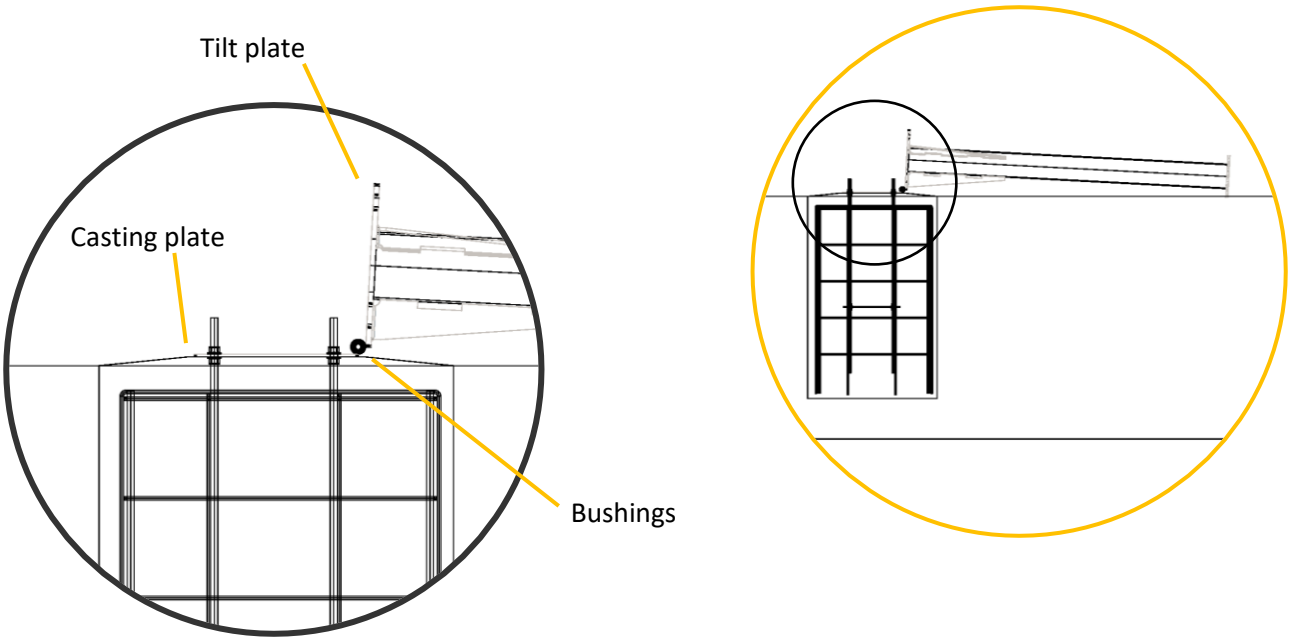
2.2.2. Pole mount

1) Pole bottom

Align the bushing of the tilt plate with the bushings of the casting plate as shown below and connect them with the M16x400mm threaded bar, washers and lock nuts.

Note: Once the concrete has hardened use the nuts to adjust the levelling of the casting plate.





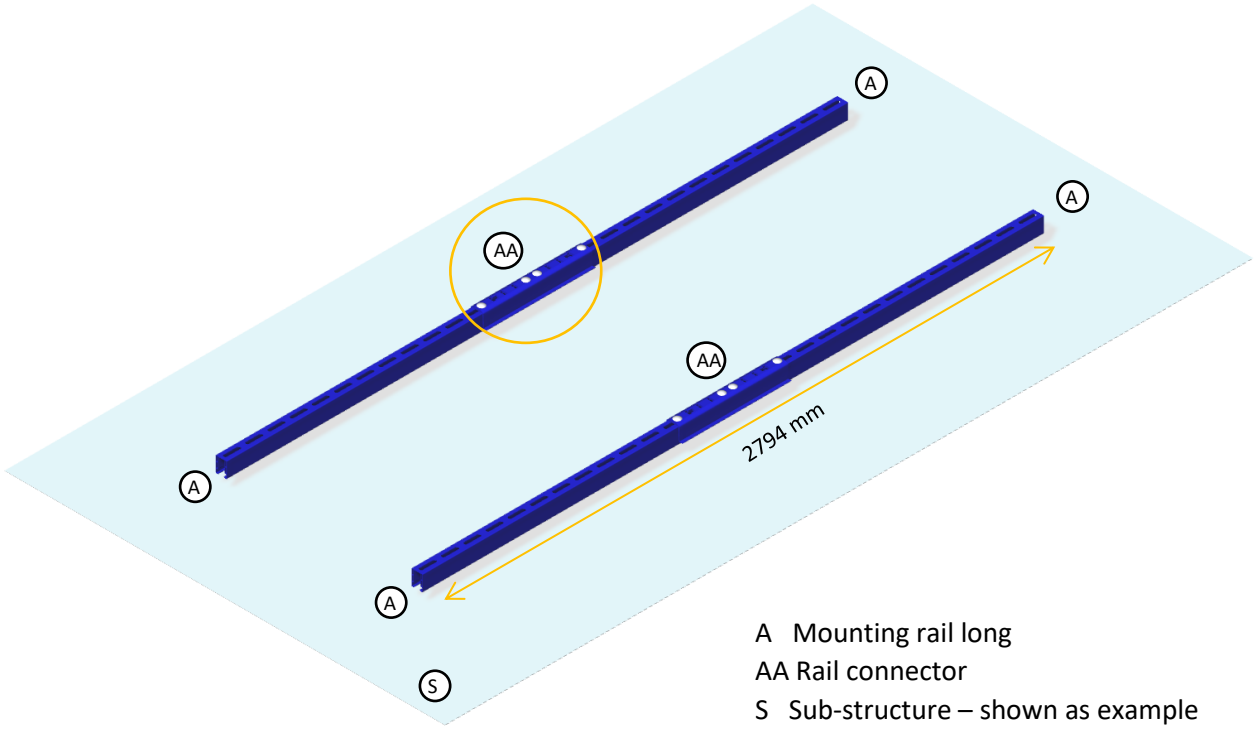
2.3. INSTALLATION – Top assembly

2.3.1. Rail assembly

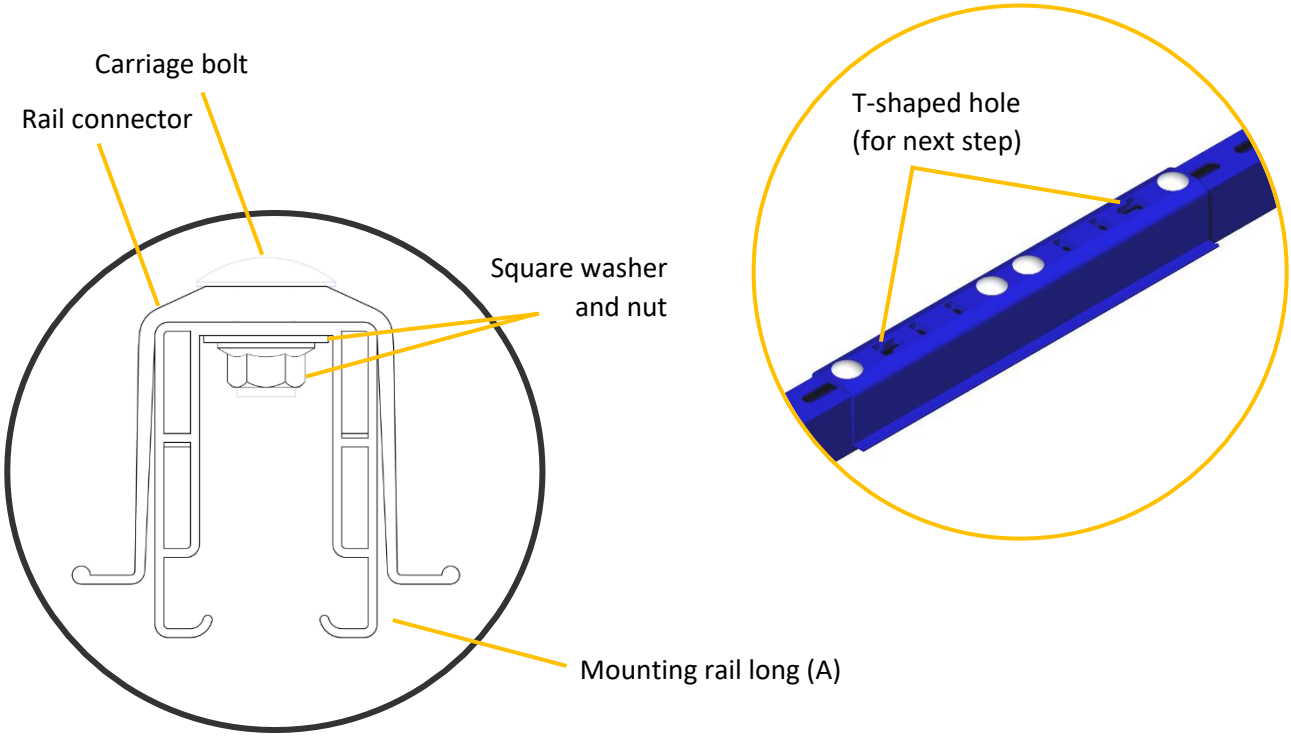
1a) Rail preparation – Rail connectors

Assemble 4 Mounting rail long in pairs with the Rail connectors (AA), carriage bolts, nuts and square washers using an 18mm socket wrench.

Note: Make sure the Rail connector is centered on the two rails

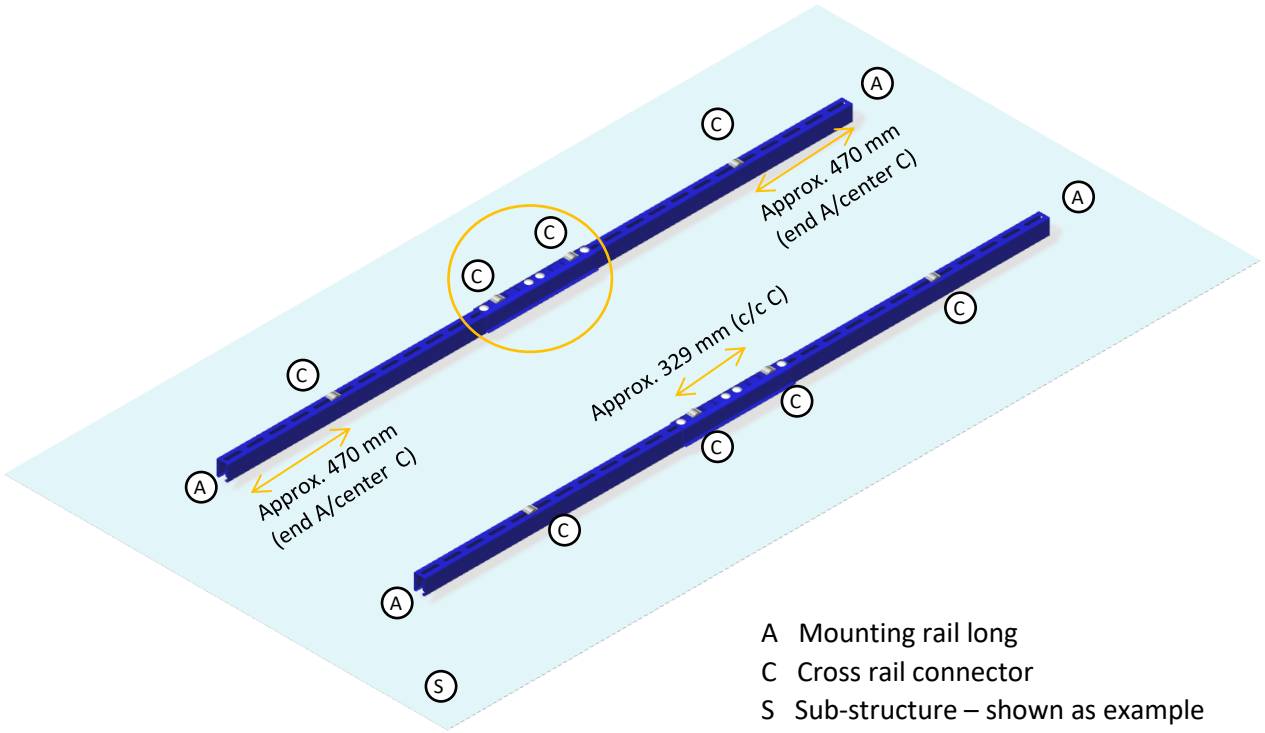


A Mounting rail long
AA Rail connector
S Sub-structure – shown as example

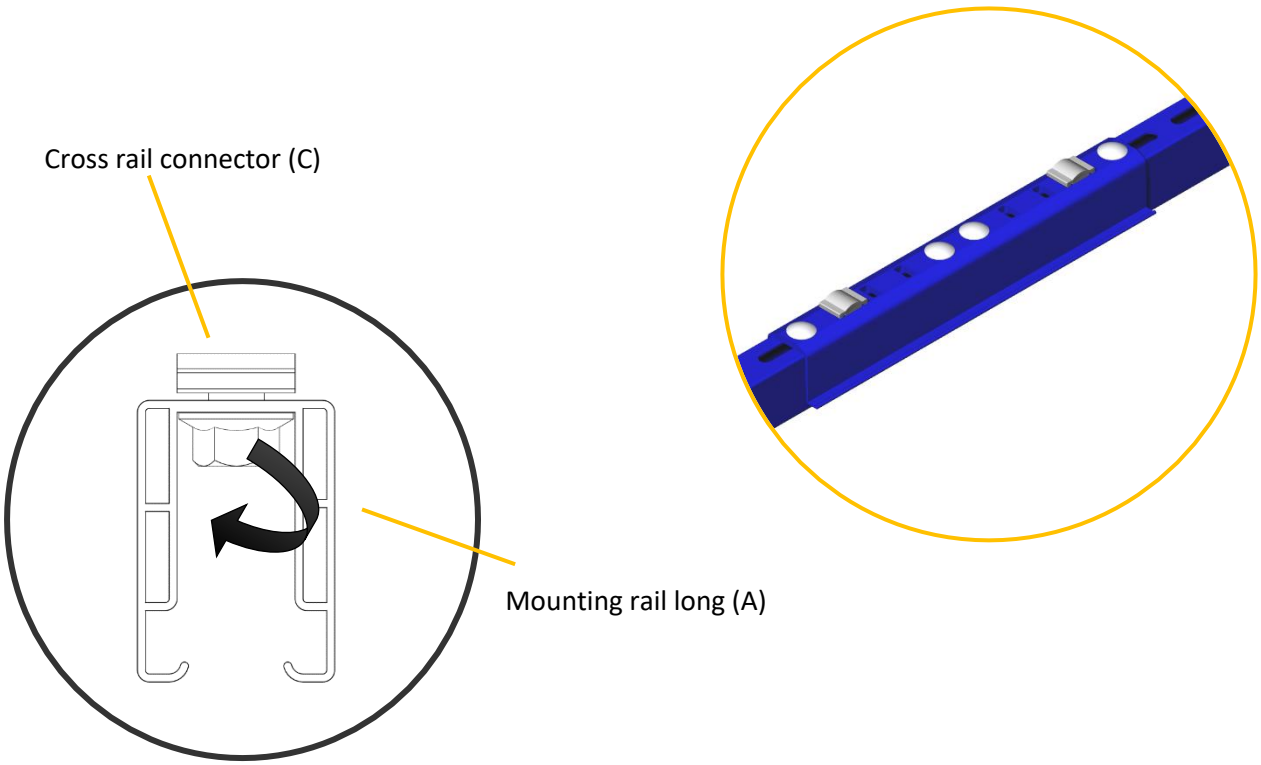


1b) Rail preparation – Cross rail connectors

Assemble 4 Cross rail connectors (C) in the T-shaped holes of the Rail connector (AA) as shown below. Next, assemble 4 cross rail connectors in the 5th hole from the ends of each rails. Only tighten the nut so the Cross rail connector is still loose, but cannot fall apart.



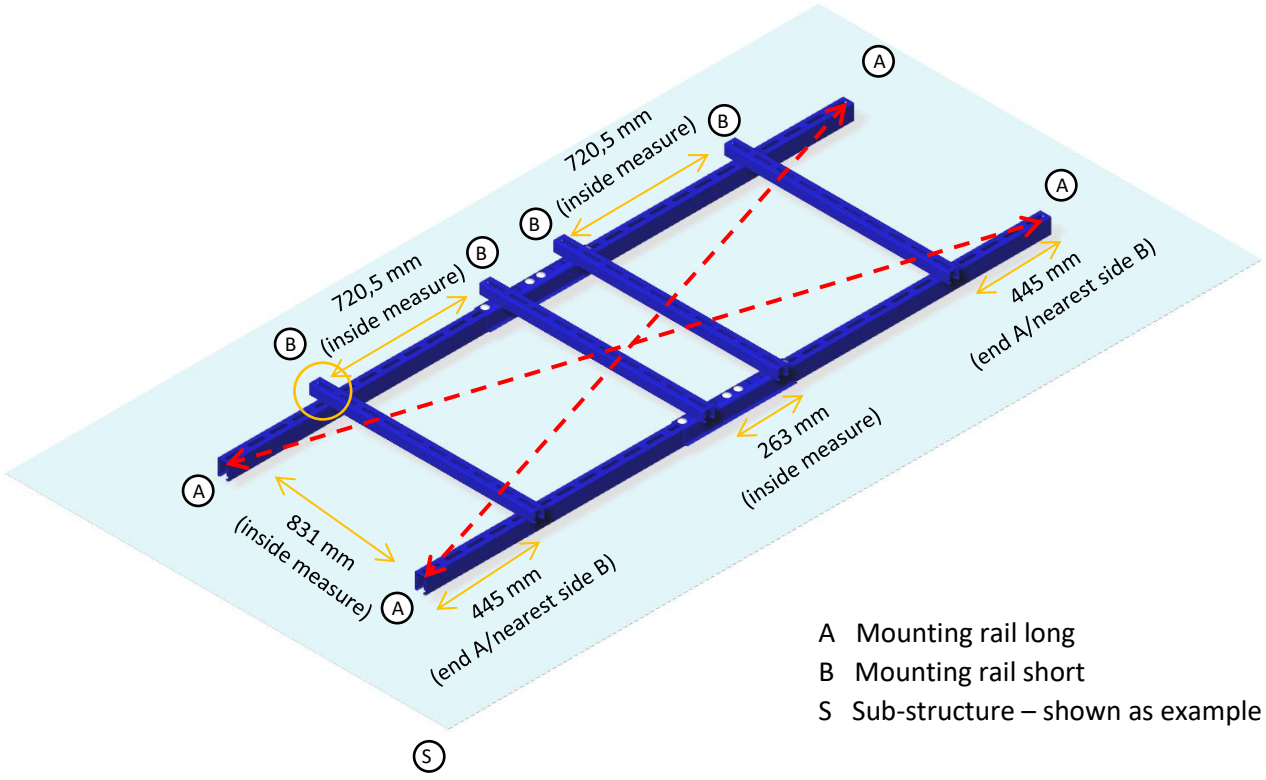
A Mounting rail long
C Cross rail connector
S Sub-structure – shown as example



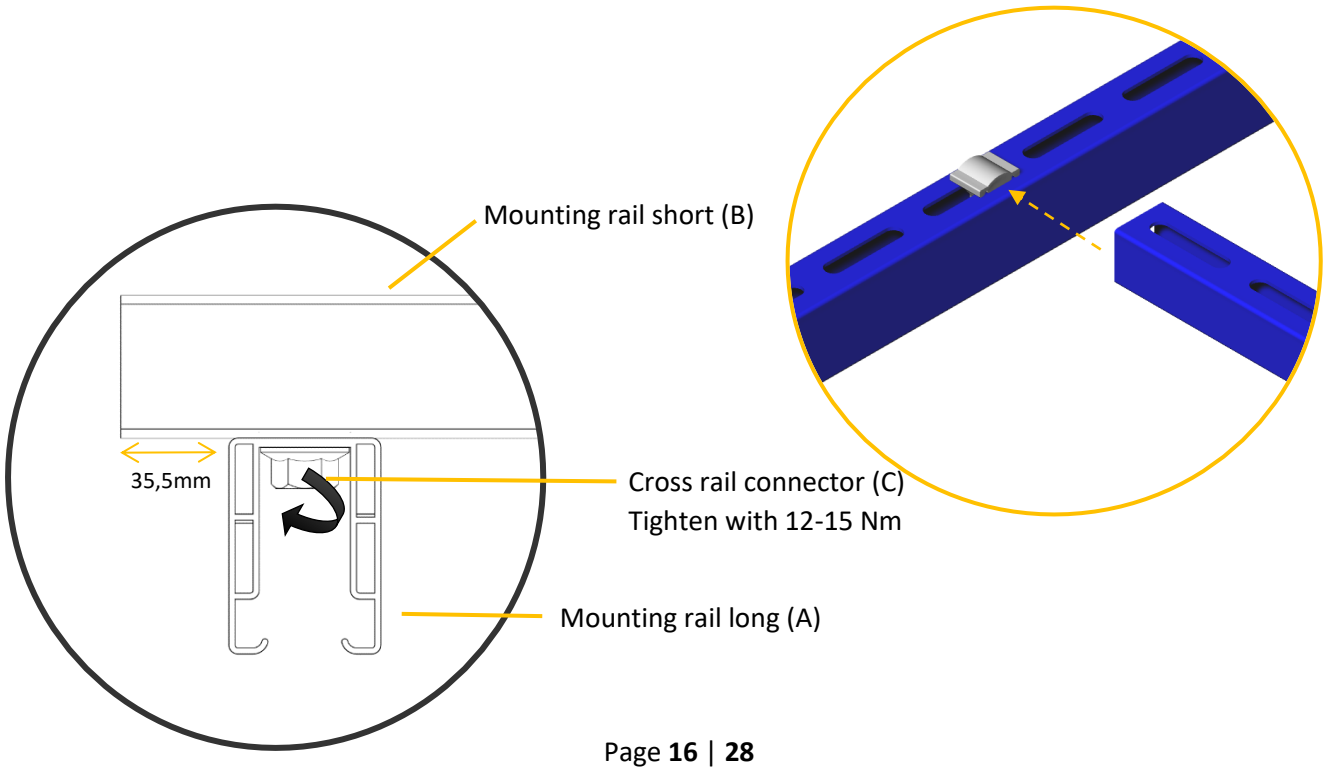
2) Mounting rails on rails

Align the rails in pair with 831 distance as shown (inside measure). Slide Mounting rail short (B) into the Cross rail connector on the Mounting rail long (A). The distance between the two Mounting rail short (B) in the middle must be 279mm (inside measure) with equal distance to center of assembly. The placement of oblong holes on the rails may vary, therefore place the rail, so the cantilever on each side is approximately the same. When all rails are mounted and placed correctly tighten the Cross rail connector nut to fix the assembly.

Note: Make sure the diagonal measurements are the same (red dashed lines).



A Mounting rail long
B Mounting rail short
S Sub-structure – shown as example



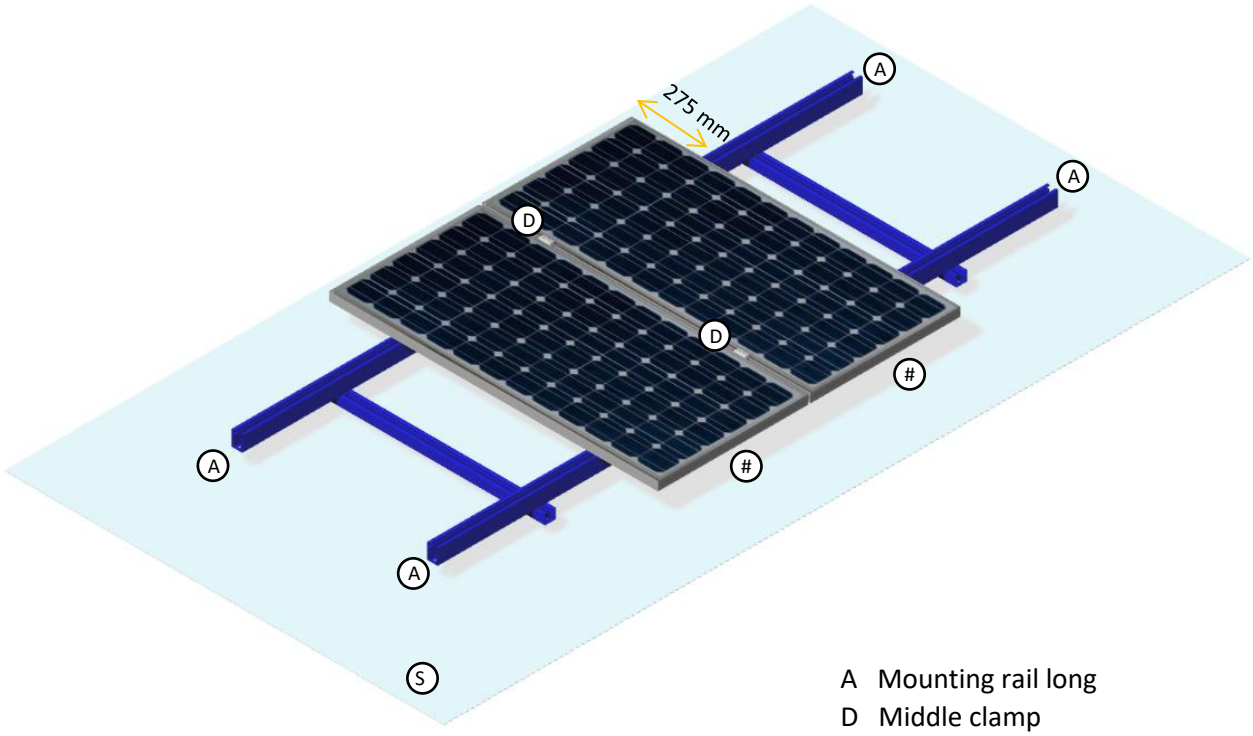
2.3.2. Panel mounting

1) Mounting first Middle clamps and PV-modules

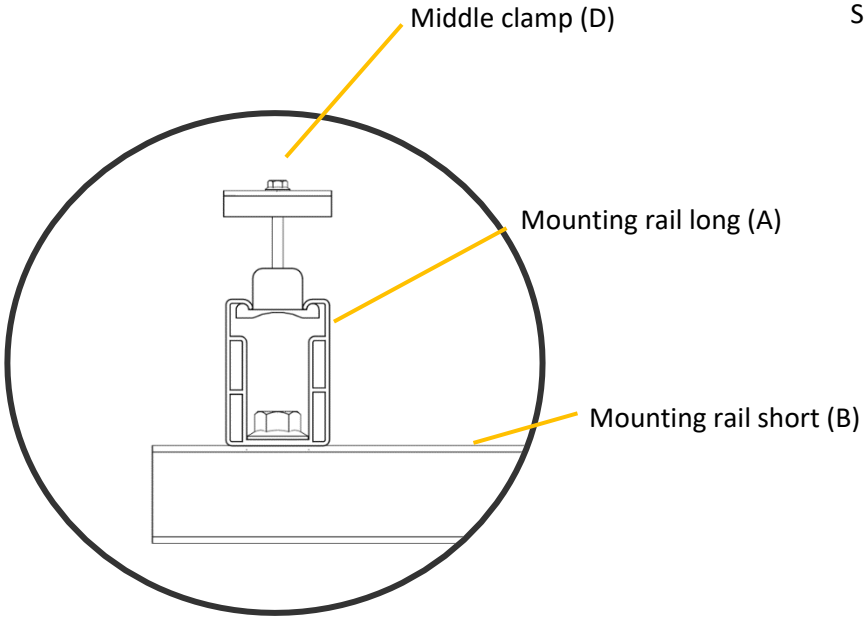
Flip the assembly with the Mounting rail long facing up. Slide a Middle clamp (D) to the center of each Rail (B) as shown below. Place a PV-module (#) on each side of the clamps.

Note: Make sure the PV-modules have equal cantilever (275 mm)

Note: Make sure the junction box on the back of the panels are aligned in the same end on all four panels



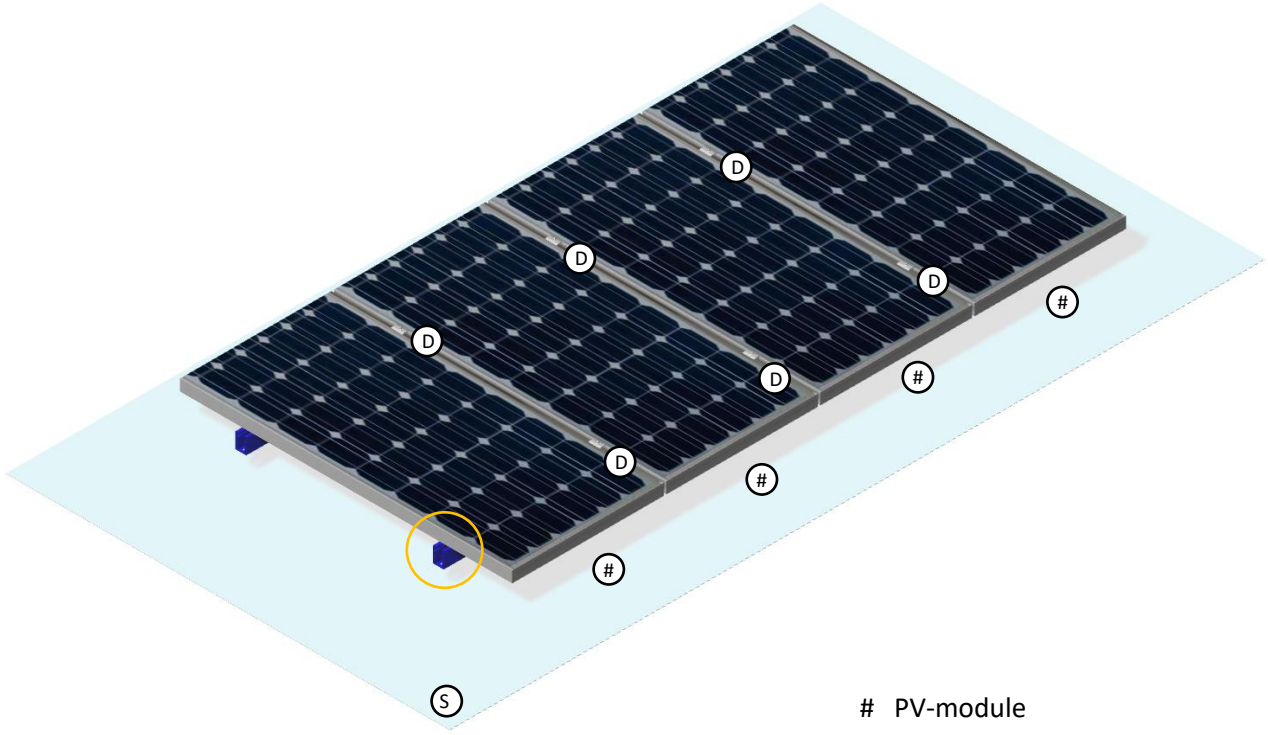
A Mounting rail long
D Middle clamp
PV-module
S Sub-structure – shown as example



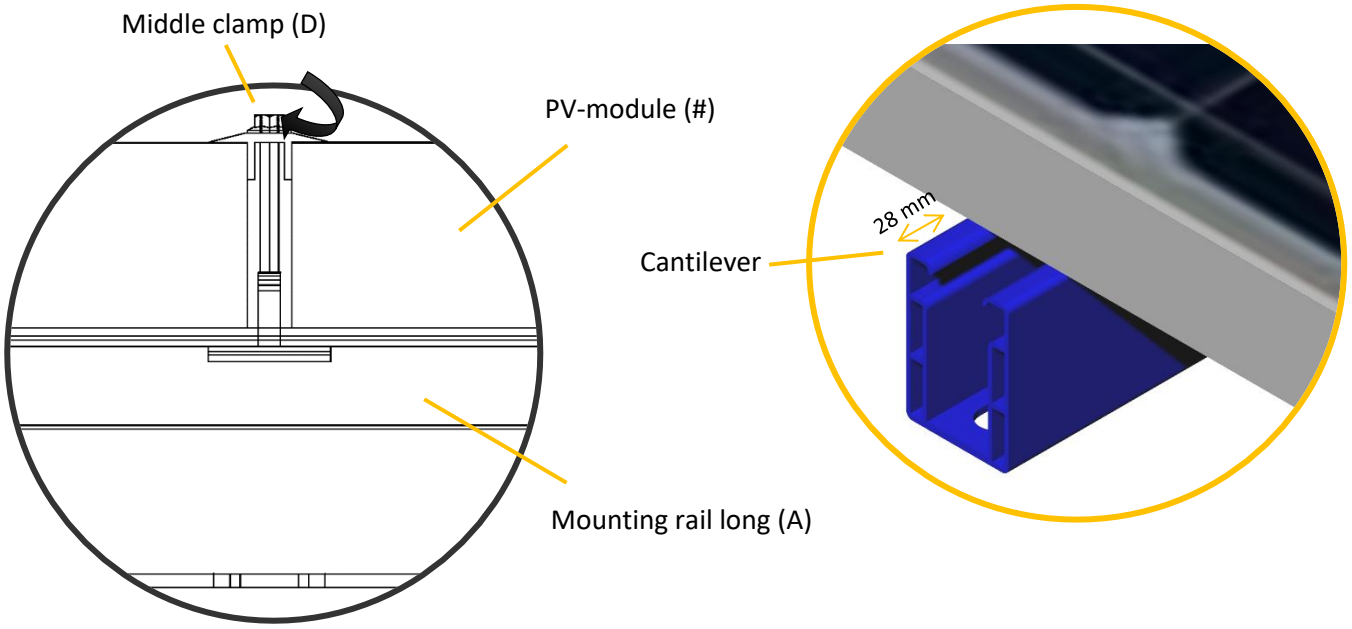
2) Mounting last Middle clamps and PV-modules

Slide 4 Middle clamps (D) on the rails surrounding the two PV-modules and then place a PV-module (#) on each side as shown below. Press the panels against the Middle Clamps (D) and tighten the clamps to fix the PV-modules to the rails with 12-15 Nm.

Note: Make sure the junction box on the back of the panels are aligned in the same end on all four panels

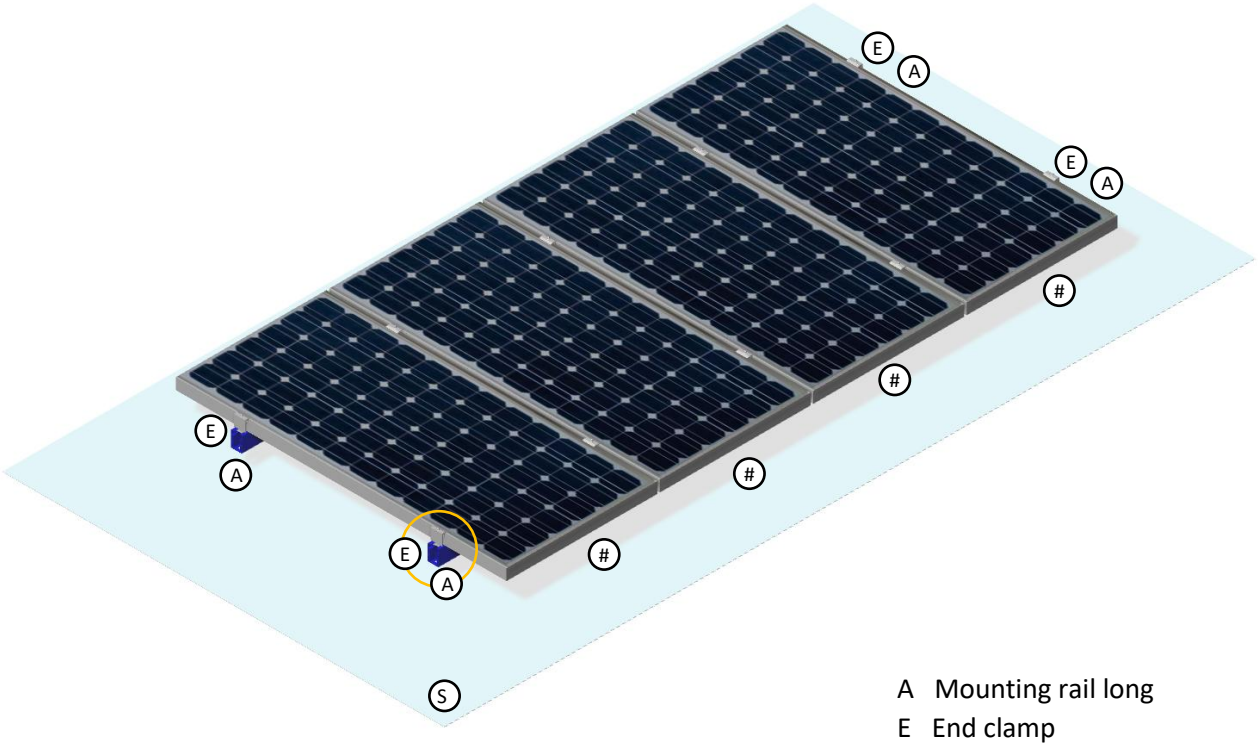


PV-module
D Middle clamp
S Sub-structure – shown as example

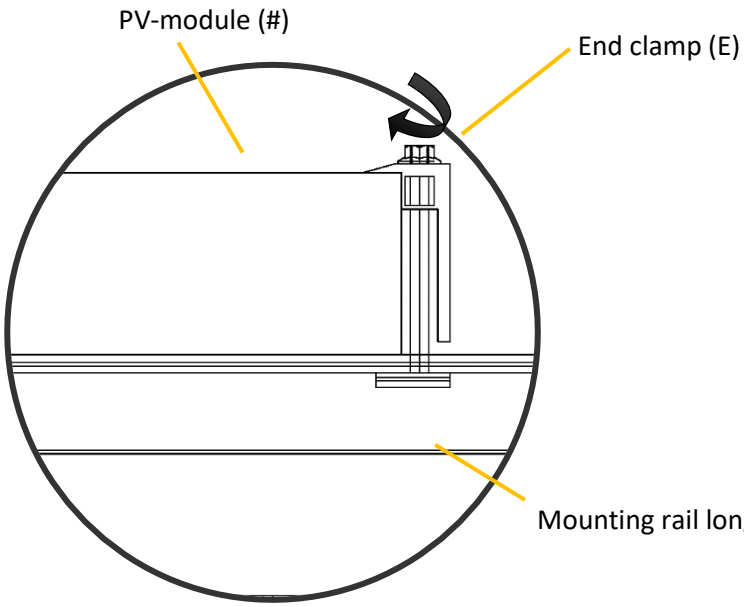


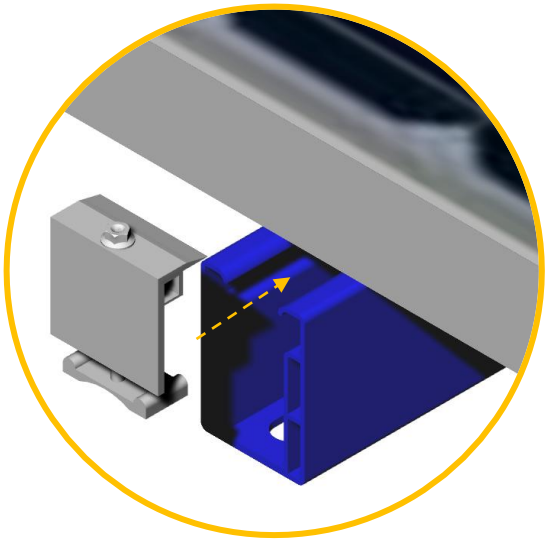
3) Mounting End clamps

Slide an End clamps (E) in each side of each Mounting rail long (A), so that it presses against the PV-module (#) as shown below. Tighten the clamps to fix the PV-modules to the rails with 9-10 Nm.



A Mounting rail long
E End clamp
PV-module
S Sub-structure – shown as example

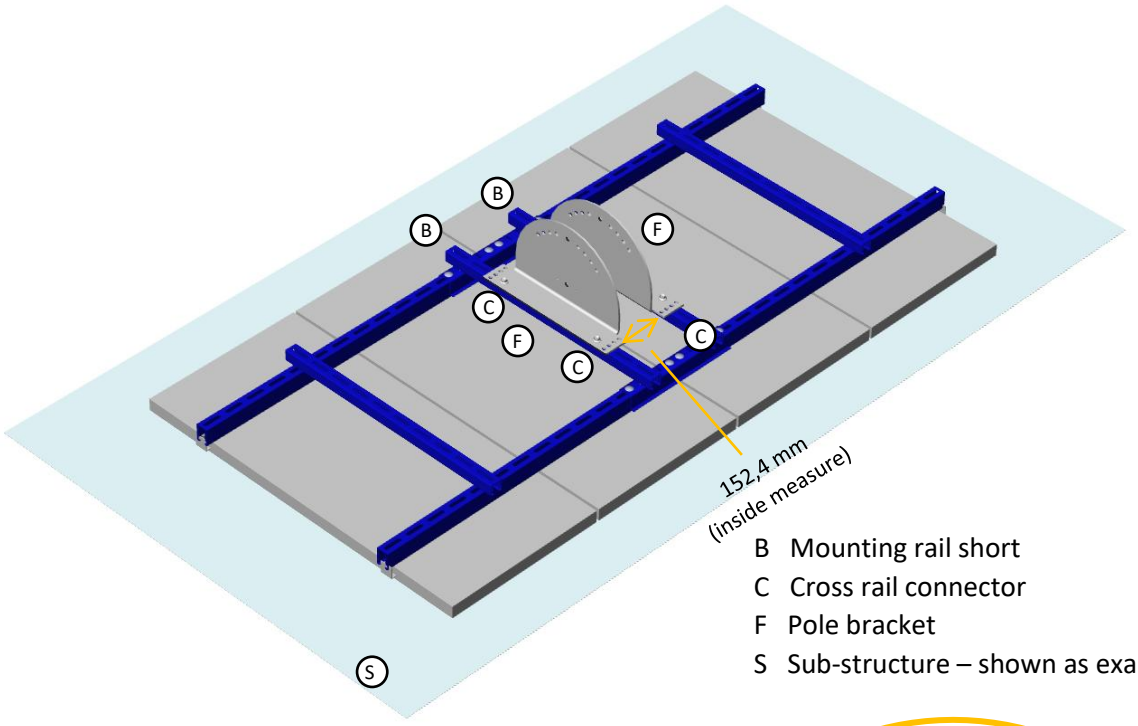




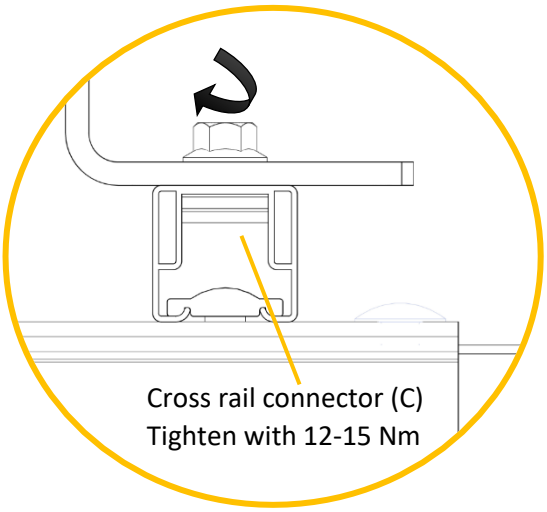
2.3.3. Pole mounting

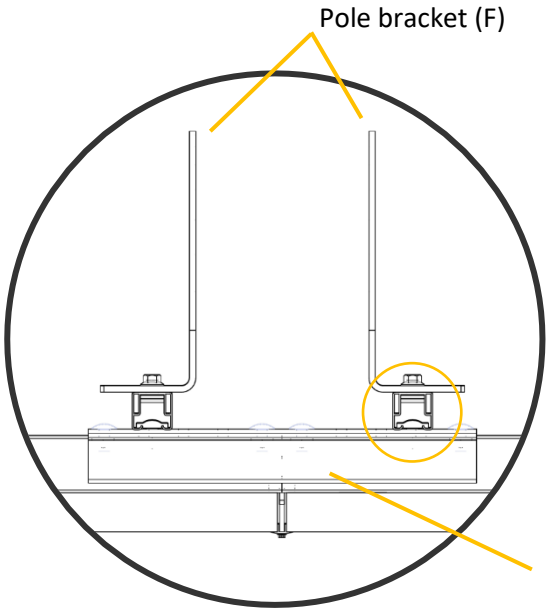
1) Mounting Pole Bracket

Carefully flip the assembly on to a plane and non-scratching surface so the panels face down as shown below. Mount the Pole brackets (F) on the Mounting rail short (B) using Cross rail connector (C) as shown below. The distance between the two Pole brackets, 152,4 mm, is measured from the inside of each bracket. Align in center, so each bracket is 76,2 mm from center of assembly.



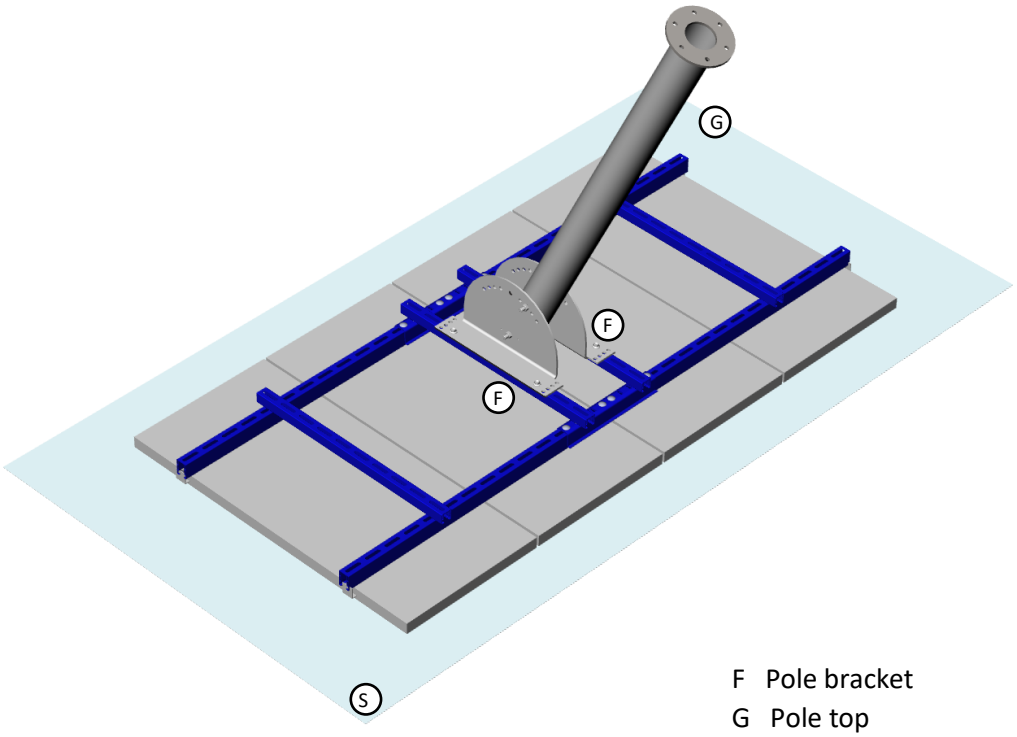
B Mounting rail short
C Cross rail connector
F Pole bracket
S Sub-structure – shown as example



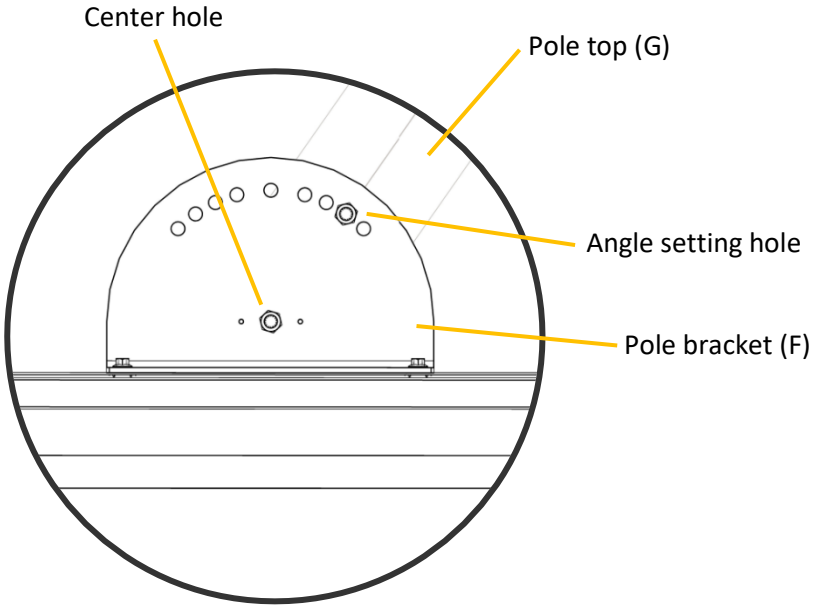


2) Mounting on Pole

Assemble the Pole top (G) between the Pole brackets (F) with two bolts and nuts – one through the center hole on Pole Bracket (F) and another through one of the nine angle setting holes. The angle setting holes can set the panels in the following angles in both directions: 0°, 15°, 25°, 35° and 45°.

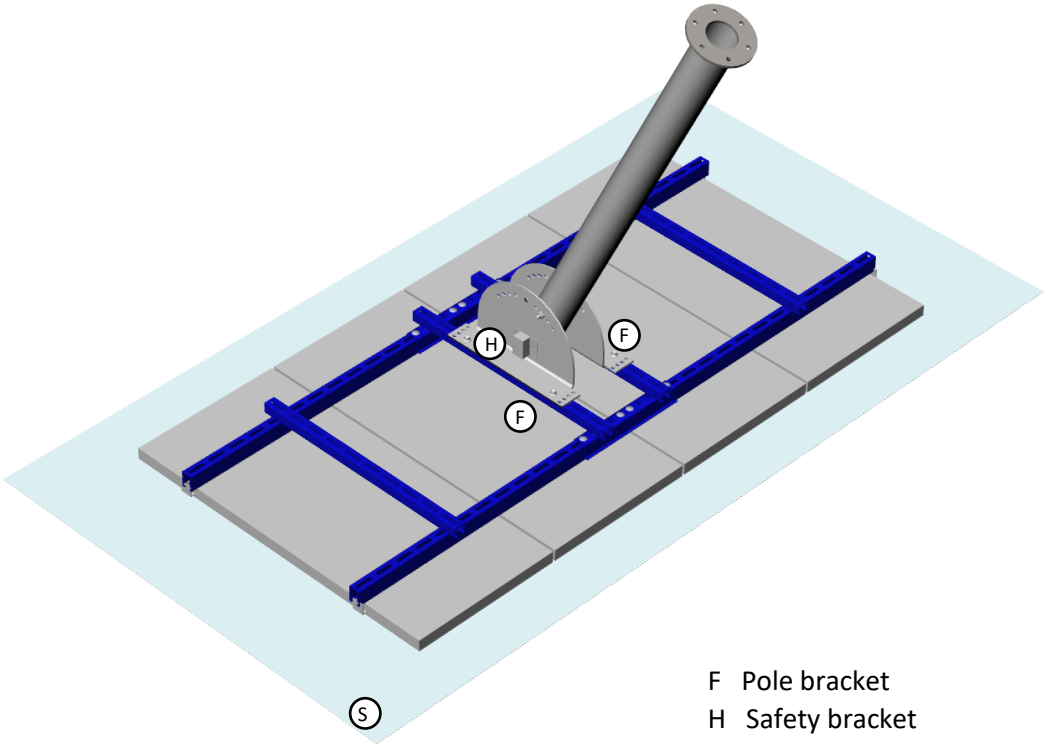


F Pole bracket
G Pole top
S Sub-structure – shown as example

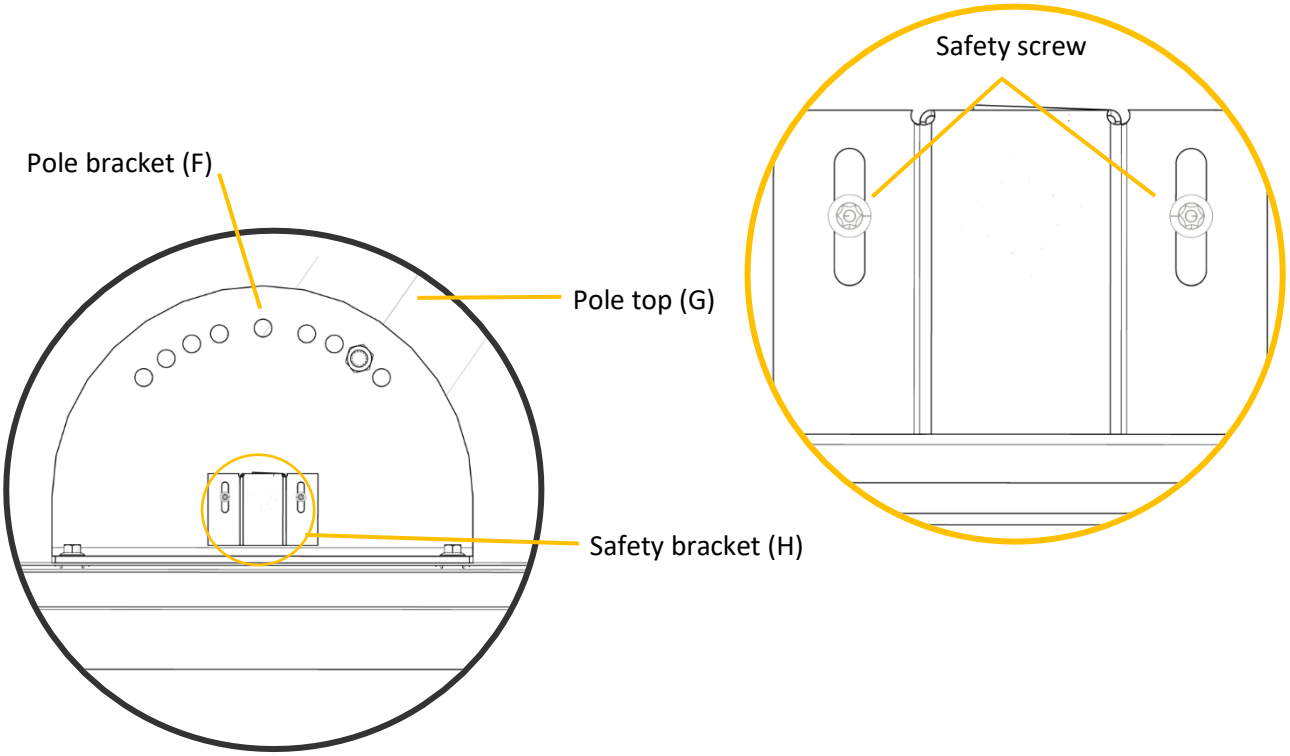


3) Mounting safety bracket

Mount the Safety bracket over the center hole of the Pole brackets on both sides* using safety screws.



F Pole bracket
H Safety bracket
S Sub-structure – shown as example

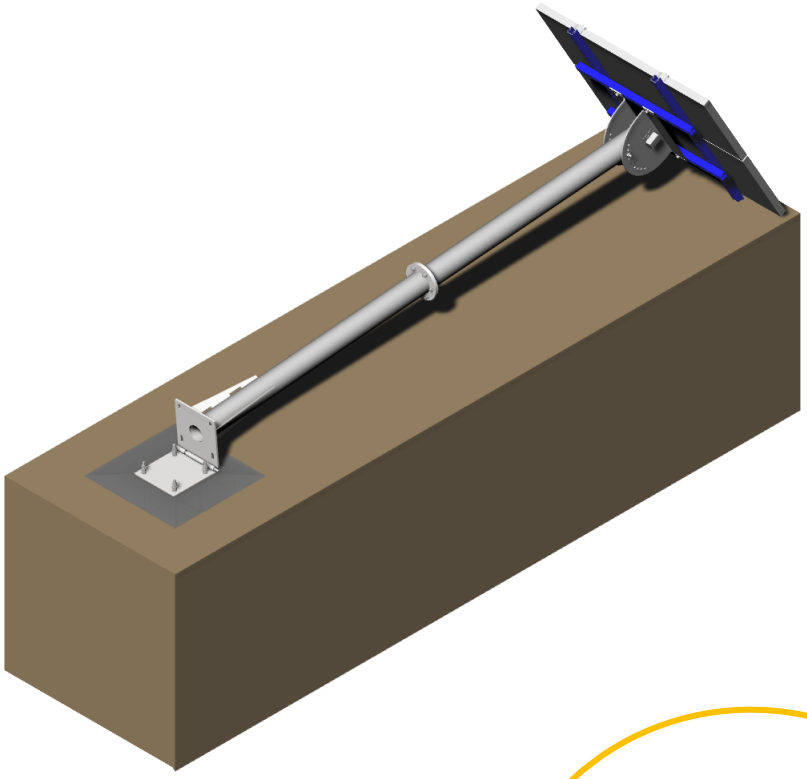


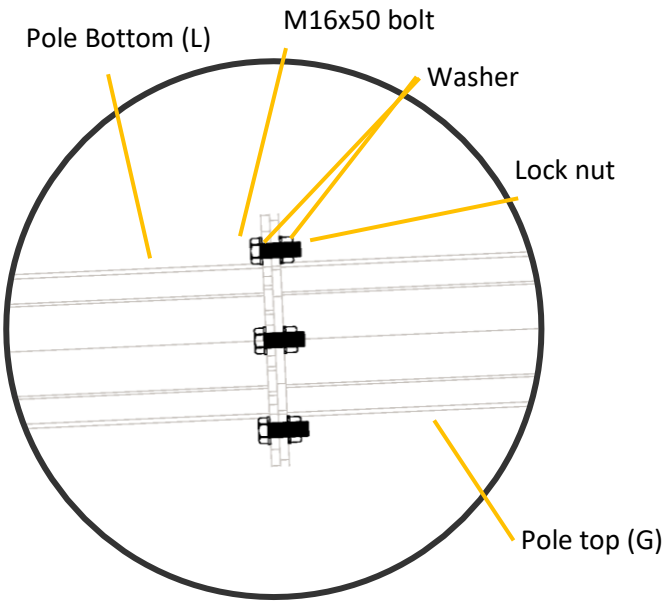
2.4. INSTALLATION – Final assembly

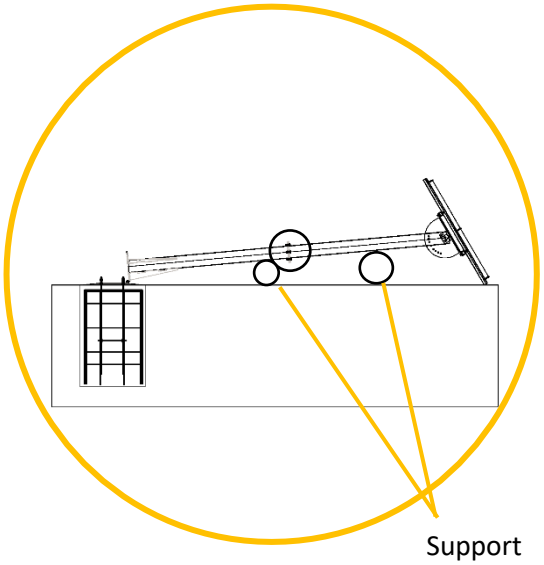
2.4.1. Assemble top and bottom

Assemble the two parts by the flanges using six M16x50 bolts, twelve washers and six lock nuts as shown below.

Note: Before assembling the two parts and raising the pole, the electrical connections must be made, as the cable must run down inside the pole and run out through the hole in the tilt plate (See section 3.1–3.3). Place support beams under the pole, to remove stress from the panels when not raised.



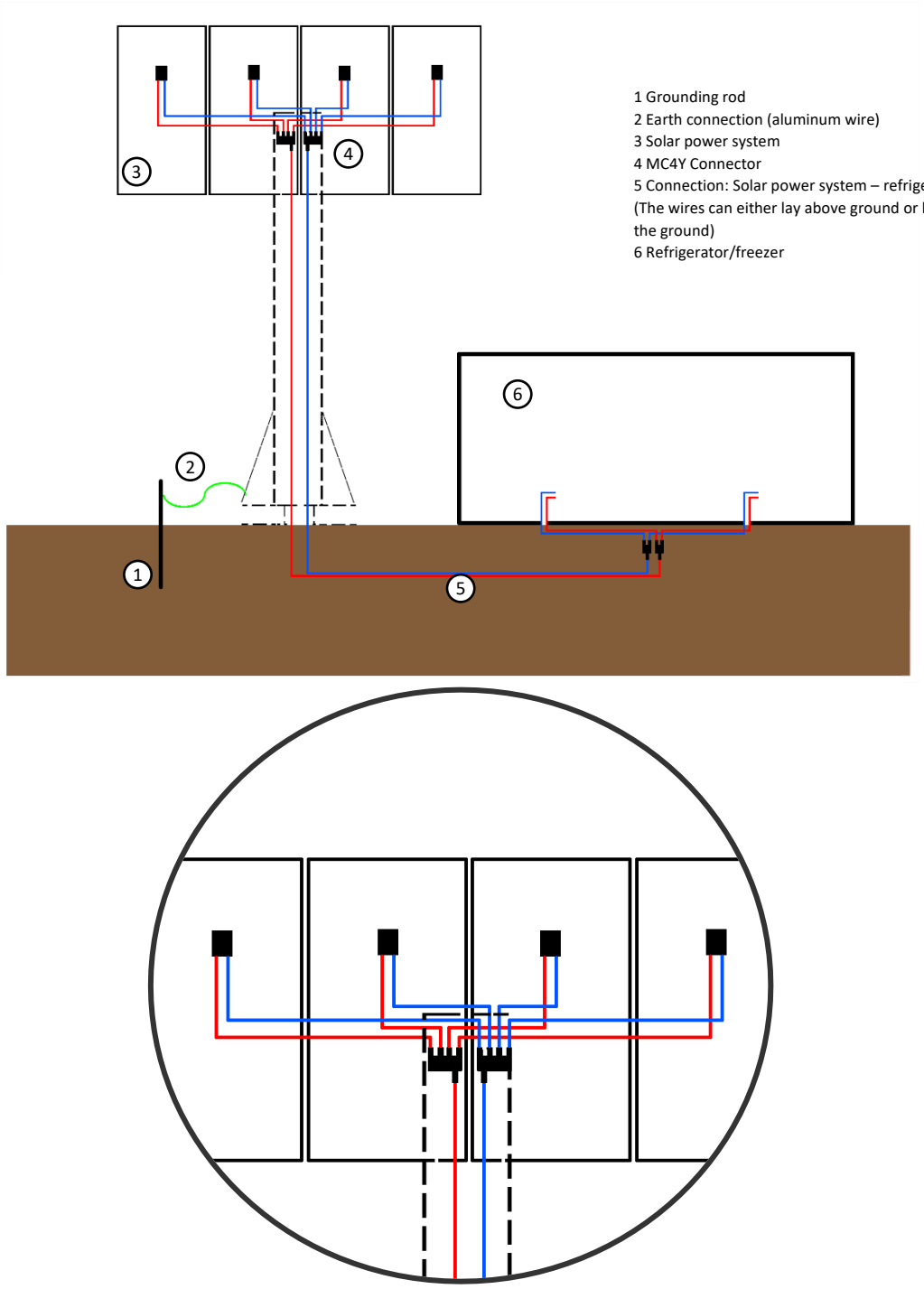




3. ELECTRICAL CONNECTION

3.1. CONNECTION PRINCIPLE

- The electronic connection consists of 2 steps:
  - connection to the ground
  - connection to the refrigerator/freezer

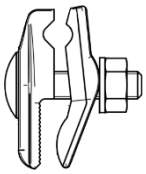


3.2. CONNECT THE SOLAR POWER SYSTEM TO THE GROUND

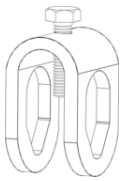
- The grounding set consists of following parts:



Aluminum wire Ø 8 mm
(1 m)



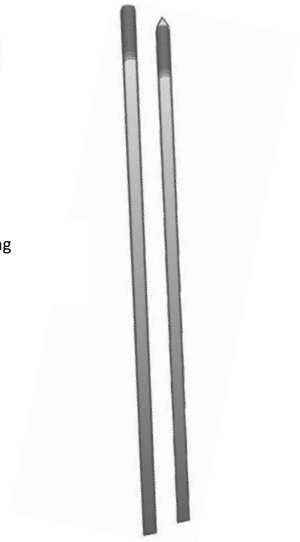
Connection clamp for
Aluminum wire
(1 pcs)



Rod clamp
(1 pcs)

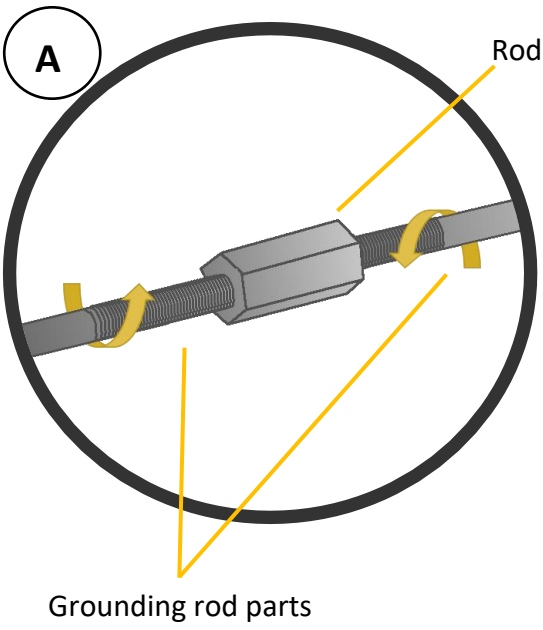


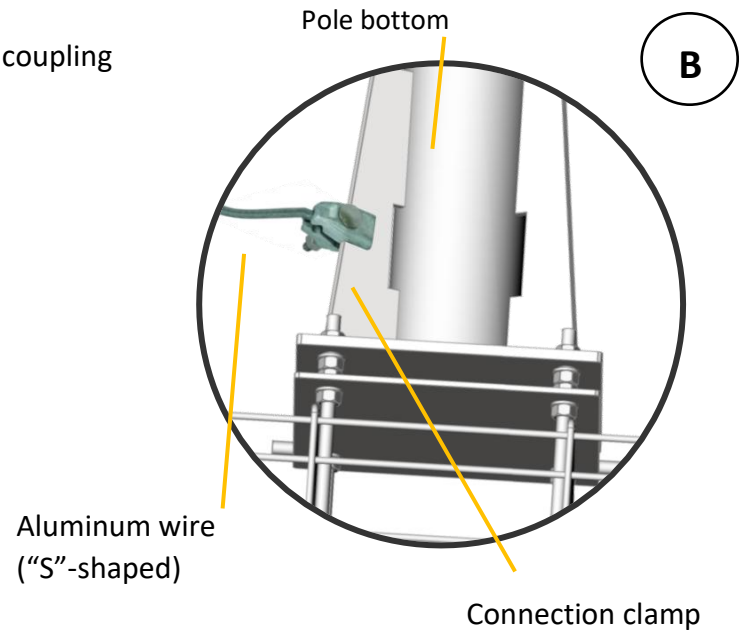
Rod coupling
(1 pcs)



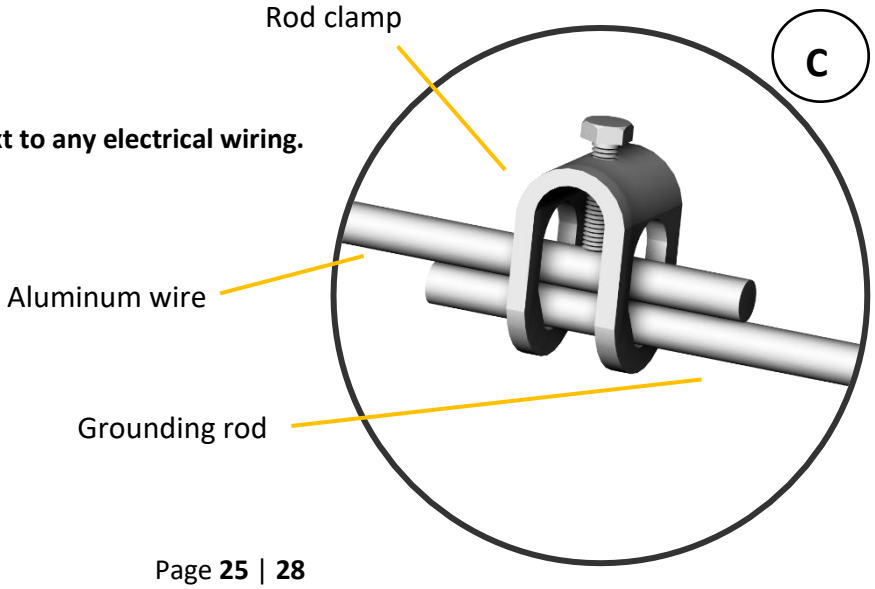
Grounding rod
(2 parts)

- Assemble the 2 parts of the grounding rod using the rod coupling (Fig. A)
- Drive the rod into the ground as near to the building and as deep as possible. Note: place a block on top of rod when hammering to prevent bending of rod.
- Connect the aluminium wire to the solar system components using the Connection clamp as shown below (Fig. B).
- After fixation on the Pole bottom, pass the aluminium wire to the grounding rod where it is fixed with the rod clamp (Fig. C).





IMPORTANT:
Do not fix the aluminium wire next to any electrical wiring.



3.3. CONNECT THE SOLAR POWER SYSTEM TO THE REFRIGERATOR

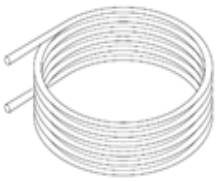
- The refrigerator set consist of following parts:



Cable clip 5-7 mm
(100 pcs)
(Use one clip per 300 mm cable)



Cable strip
(12 pcs)



6 mm² rodent proof cable
with MC4 Connector
(2 x 20 m)



Extender cable with MC4Y connecter
NOT rodent proof – for use inside pole only
(2 x 4 m)

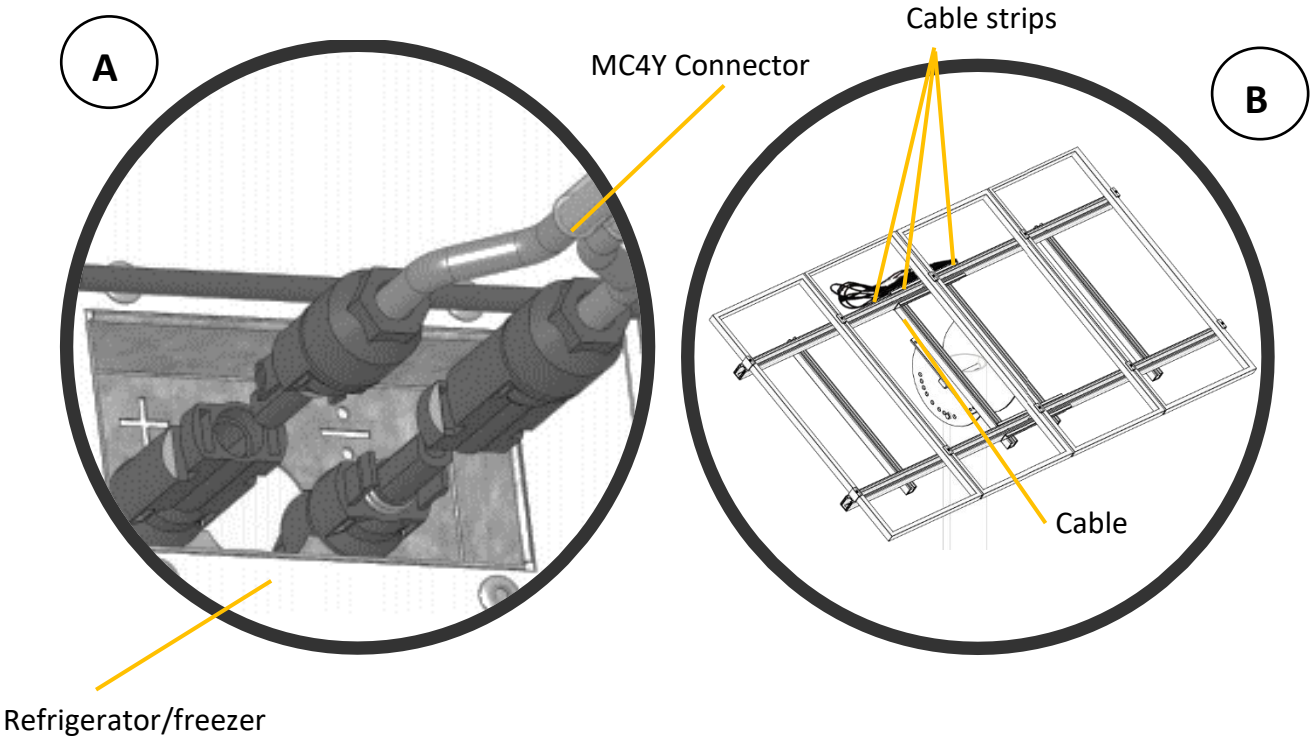


MC4Y Connector
(1 sets)

- The connection of the refrigerator/freezer to the solar power system is made with the provided cables (Fig. A)

Note

The cable strips are used to tie the connected cables together, possibly under the PV-modules (Fig. B).



4. RAISE POLE AND FIXATE

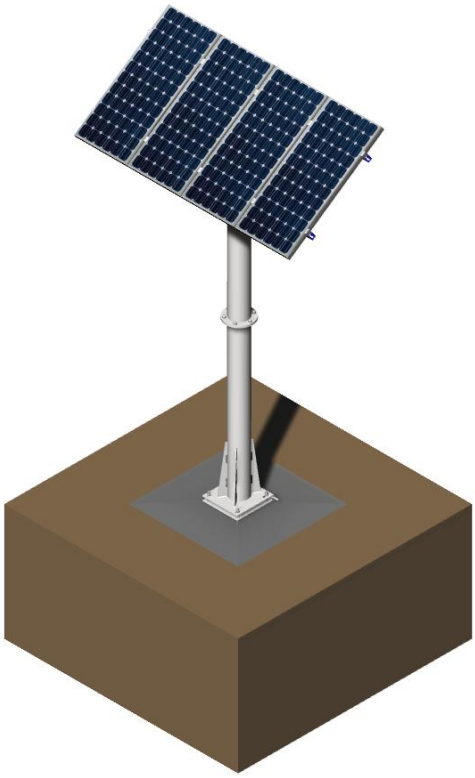
Raise the assembly to upright position and fixate the tilt plate using washers and lock nuts as shown below.

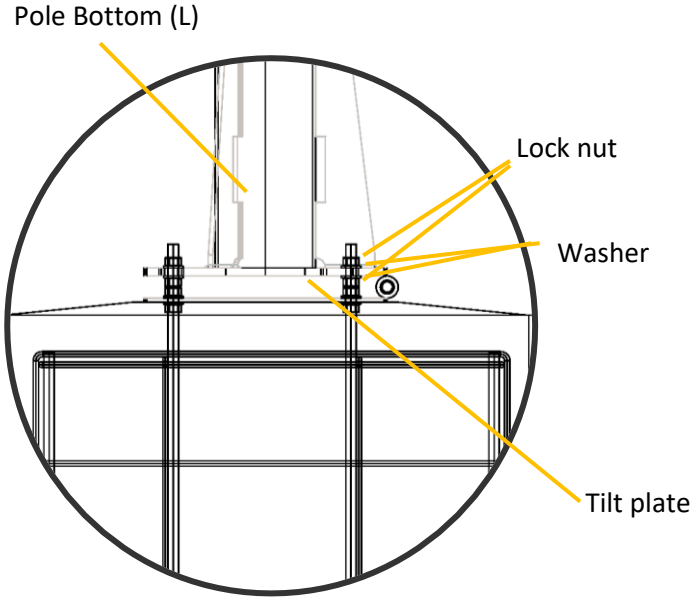
Caution:

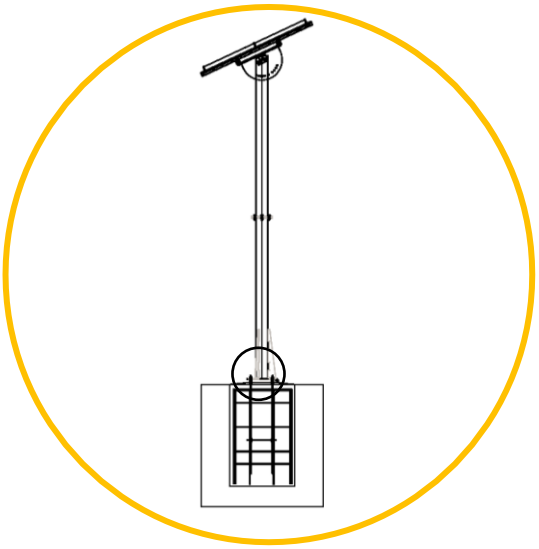




- Wear hard hat and protective gloves when raising the pole
- Do not stand below the pole or solar panels, when raising the assembly
- Four to six persons are recommended for raising the assembly – tie a rope around the pole above the bolted flanges for one to two person(s) to pull. The other three to four persons must use suitable sticks/logs or two tied together as pole support so they cannot be hit in the event the assembly should fall when raising







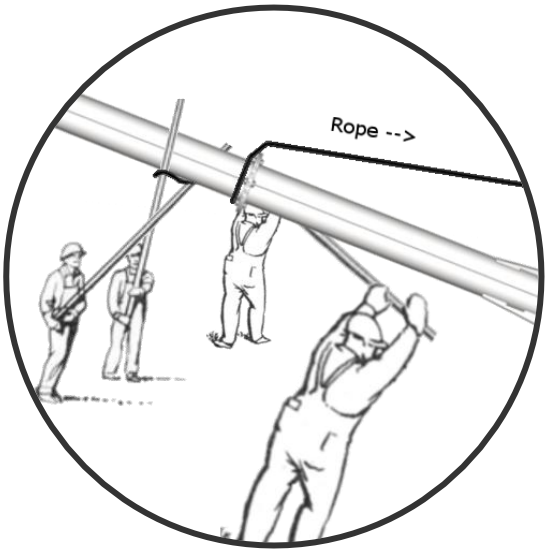
ANNEX 1 – Example of pole support and raising assembly

Picture 1 shows an example of how to make a pole support.

Two sticks connected with a nut and bolt to make a cross, a robe at the top to hold the pole and a cross brace to keep position.



1 - Pole support example



2 – Illustration of raising the assembly

Picture 2 shows how to raise the assembly.

Two persons at the bottom uses a stick or log to lift the pole, and two persons use a pole support to lift at the top.

Tie a rope around the pole above the flanges – two persons pull the rope.

Caution: Do not stand directly below the pole or solar panels, when raising the assembly.