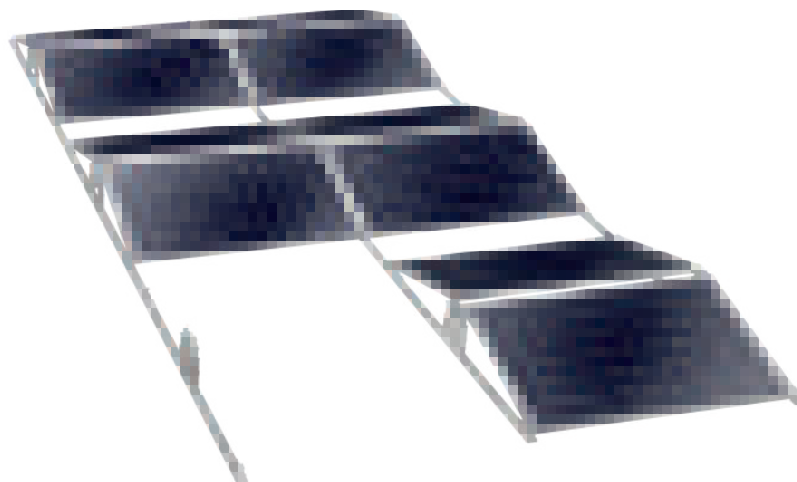


PROINSO PV RACK **TRIANGLE E-W PRO**



Robust aluminium structures
designed and made in Europe



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1. INTRODUCTION

1.1. BRIEF DESCRIPTION

The Triangle E-W Pro flat roof system is a rugged frame system for the assembly of PV modules on flat roofs. The Triangle E-W Pro system allows for the connection of several rows of modules in East-West direction. The standard pitches of the system are 10° and 15°. Triangle E-W Pro is used for module areas of at least 10m². Triangle E-W Pro was especially designed for applications on flat roofs with low admissible load capacity. The design of all components ensures easy assembly. The tried and tested Clickstone technology, standard preassembly and clever product design on the basis of only a few individual parts allow for short assembly times and minimum tool requirements. The parts used are made of aluminium and stainless steel. Their high degree of corrosion resistance guarantees maximum service life and full recyclability.

1.2. ON THESE INSTRUCTIONS

SUBJECT

This manual describes the assembly of the Triangle E-W Pro flat roof system as well as any system-specific information on planning, components and safety instructions. The drawings in the first part of the manual show the assembly of the system for the corner clamping of framed modules. The additional steps which are required for rail clamping at the long module side are described separately in chapter 6.

FURTHER APPLICABLE DOCUMENTS

In addition to this document, the document "Installation Manual - General Information" is provided on our website at www.proinsopvrack.com. Here you can find general information on standards, safety, transport, maintenance, disassembly and disposal applicable to PROINSO PV Rack's place of assembly. Both these Installation Manual and the "Installation Manual - General Information" are an integral part of the Triangle E-W Pro mounting system and must be observed for each installation.

It is essential that you read these Assembly Instructions as well as any further applicable documents prior to starting assembly, maintenance and disassembly work. In case of further queries, please contact PROINSO PV Rack.

USER GROUPS

All assembly instructions of Proinso PV Rack are addressed to the following persons (user groups):

- specialist staff
- instructed staff

SPECIALIST STAFF

Specialist staff are those persons who, due to their professional training, are in the position to carry out proper assembly and maintenance as well as disassembly work.

INSTRUCTED STAFF

Instructed staff are those persons who have been adequately instructed and trained on the tasks assigned to them and on possible hazards in case of incorrect behaviour. Instructed staff must have been familiarised with the required protection devices, protective measures, relevant regulations, accident prevention regulations as well with operating conditions and must have received the corresponding proof of competence. The work accomplished must be approved by the specialist staff.

ORIENTATION GUIDE

The following pictograms allow for the easier orientation in this manual:

PICTOGRAMS



This symbol indicates important information and useful notes.



This symbol indicates tips and tricks for easier procedures.

1.3. WARNING NOTICES

The warning notices used in this Installation Manual indicate safety-relevant information. They include:

- warning symbol (pictogram)
- signal word indicating the hazard level
- information on the type and source of hazard
- information on possible consequences if hazards are disregarded
- measures to be taken in order to prevent
- hazards and avoid injuries or damage

The signal words of the warning notices indicate the following hazard levels:



DANGER

Indicates a great, exceptional danger which, if not avoided, will result in severe personal injury or death.



WARNING

Indicates a potentially dangerous situation which may result in severe or moderate personal injury and damage to property.



CAUTION

Points out a possibly dangerous situation which, if not avoided, may result in minor or light personal injury and damage to property.



ATTENTION

Indicates a potential danger which may result in damage to property.

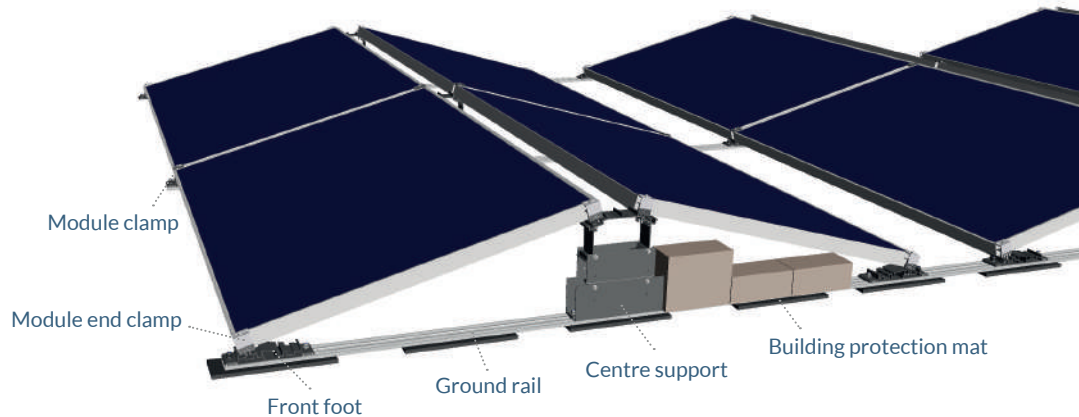
1.4. SAFETY

The complete general safety regulations for the frame systems supplied by Proinso PV Rack are included in the further applicable document "Installation Manual - General Information". Read this document with care and always observe the notices contained use the frame only in compliance with its intended purpose. Observe the duties of the principal and follow the general as well as the specific safety instructions. For any jobs you accomplish, the specific safety notes which precede the instruction steps in this productspecific Installation Manual must also be observed.

2. TECHNICAL DESCRIPTION

2.1. SYSTEM OVERVIEW

The following illustration shows all system parts.



The design of each system part may vary. It depends on:

- the type of roof
- the type of module
- the number of modules
- the local conditions

2.2. COMPONENTS

The following illustration shows all parts of the Triangle E-W Pro system which can be included in the scope of delivery. The exact scope of delivery as well as the number of individual system parts depend on your order. Building protection mats can be ordered at Proinso PV Rack as an option, but are required for assembly.

2.3 TECHNICAL DATA

APPLICATION	Flat roofs
ROOFING	For all roof coverings (also gravel)
ROOF INCLINATION	5°
BUILDING HEIGHT	Depends on wind loads on site
PV-MODULES	Framed, frameless
MODULE WIDTH	900-1050mm
MODULE LENGTH	Up to 1675mm (longer modules on request)
MODULE LAYOUT	In connection
MODULE ORIENTATION	Landscape
PITCH	10° or 15°
SIZE OF MODULE ARRAY	Min. 10m ²
POSITION OF THE MODULE ARRAY	No special requirements
STANDARDS	Eurocode 0 - Basis of structural design Eurocode 1 - Action on structures Eurocode 9 - Design of aluminium structures
SUPPORTING PROFILES	Extruded aluminium profiles (EN AW 6063 T6)
RAIL FIXATIONS	Side fixing clip: Aluminium (EN AW 6063 T6)
SMALL PARTS	Stainless steel (V2A)
COLOUR	Aluminium: plate finish
WARRANTY	10 years



3. IMPORTANT ASSEMBLY NOTES

3.1 APPLICATION CONDITIONS

Ballast stones are applied on the ground rails in order to secure the mounted flat roof system. The arrangement of the ballast stones is provided in your individual ballast plan. The ballast plan is included in the scope of delivery. The customer must ensure that the roof is capable of carrying the additional weight of the system and the ballast stones.

3.2 ASSEMBLY PREPARATION

Proinso PV Rack recommends gathering information on the on-site conditions before ordering Triangle E-W Pro. In particular, you should familiarise yourself with:

- the roof structure (e.g. surface material)
- the admissible additional load reserves of the roof
- the adequate fixation of the supporting construction on the roof surface

3.3 ASSEMBLING AID AND REQUIRED TOOLS

The following tools are required for the assembly of the frame system:

- Allen wrench, 5 mm
- Impact wrench with a tightening torque of min. 180 Nm or an M13 ring spanner wrench
- Elongation for impact wrench
- Attachment for impact wrench, 13 mm nut
- Chalk line
- Spirit level
- Folding rule / measuring tape
- Lifting gear (e.g. roofer lift, harness)
- Plunger elevator
- Spacing template (included in the scope of delivery)
- Gloves

3.4 EXPANSION JOINTS

Due to thermal expansion, the system must be designed with joints which must be taken into account for the ballast plan. The following data can be used for module design:

CORNER CLAMPING:

In North-South direction	every 10 modules
In East-West direction	every 5 double modules

RAIL CLAMPING:

In North-South direction	every 6 modules
In East-West direction	every 5 double modules

3.5 ON THE ASSEMBLY DESCRIPTION

The following chapters describe all steps necessary for the planning and assembly of Triangle E-W Pro in their correct order. Chapter 5 describes the assembly steps for the corner clamping of the modules at the short side, chapter 6 includes the additional assembly steps necessary for the rail clamping of the modules at every quarter of the long side. Follow these assembly steps and make absolutely sure to observe the safety instructions.



DANGER

DANGER TO LIFE DUE TO FALLING PARTS!

Parts falling from the roof may cause severe injury or death!

- Before starting assembly, make sure that the material used meets the on-site static requirements.



DANGER

DANGER TO LIFE DUE TO DAMAGE TO THE ROOF

Excessive load may severely damage the roof!

- Before starting assembly, make sure that the building and in particular the roof cladding meet the static requirements which will increase due to the PV system and during assembly work.



DANGER

DANGER TO LIFE DUE TO DAMAGE TO THE ROOF

Excessive load may severely damage the roof!

- Before starting assembly, make sure that the building and in particular the roof cladding meet the static requirements which will increase due to the PV system and during assembly work.



DANGER

DANGER TO LIFE DUE TO FALLING PARTS!

Parts falling from the roof may cause severe injury or death!

- Before starting assembly, make sure that the material used meets the on-site static requirements.

4. PLANNING OF THE MODULE AREA

Before you can start assembly, the following tasks must be accomplished:

- Clean the roof surface.
- The first row must always be mounted towards the front roof edge (East or West).
- Align the installation area because roof areas are not always at right angles.
- Apply, for example, a chalk line at the first row to align the front side.

We highly recommend using building protection mats in order to avoid damage to the waterproofing of the roof. Building protection mats are supplied as an option and can be ordered at Proinso PV Rack. Depending on the surface structure of the roof, we recommend the following building protection mats:

ROOF	BUILDING PROTECTION MAT
Bitumen-coated	Standard
Foil roof	Coated on one side with aluminium
Gravel-covered and green roof	Optional, recommended

Three building protection mats for each double-frame mounting must be placed under each ground rail (one each under every front foot and every centre support). If additional ballast support components such as ballast profiles or L-profiles are used, additional building protection mats are required. The following calculation applies:

- Ballast profile:
 - 220 mm: 2 additional building protection mats for every 2 ballast profile
 - 450 mm: 2 additional building protection mats for every 2 ballast profile
 - 650 mm: 3 additional building protection mats for every 2 ballast profiles
- L-profile: 2 additional building protection mat for every 2 L-profiles

Make sure that the building protection mat protrudes from both ends of the ground rail by approx. 50 mm. This is to ensure optimal protection for the roof surface.





DANGER

DANGER TO LIFE DUE TO FALLING!

Falling from the roof may cause severe injury or death!

- Wear the protective equipment stipulated by the law!
- Secure yourself against falling!
- Do not work on the roof during high wind!



DANGER

DANGER TO LIFE DUE TO FALLING PARTS!

Parts falling from the roof may cause severe injury or death!

- Seal off the danger zone on the ground prior to starting assembly work in order to prevent persons from being injured by falling parts!
- Make sure to secure the parts so that they cannot fall down the roof!
- Wear the protective equipment stipulated by law!
- Do not stand in the danger zone!
- Do not work in high wind!
- After having completed assembly, check the frame system and the modules whether they are tightly secured!

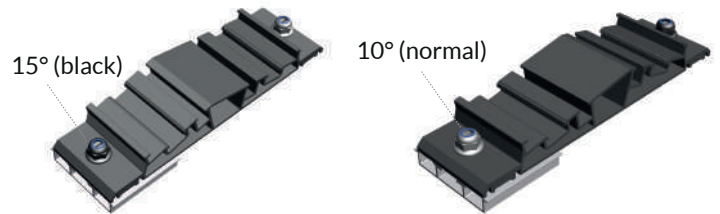
5. CORNER CLAMPING ASSEMBLY

5.1 LAYING AND MOUNTING THE FIRST MOUNTING FRAME ROWS

Before laying and aligning the first ground rails, we recommend that you pre-assemble the short ground rail pieces (60 mm). The short ground rail pieces (60 mm) form both ends of each mounting frame row. We recommend that you pre-assemble short pieces at the first front foot.

In this context, the front foot is used as a connection between the rails as well as for module alignment. Keep in mind that the front foot is designed both for 10° and 15° frames.

The 15° side of the foot is marked by the black nut. This means that the black nut of 15° mounting frames must be aligned towards the short rail piece as well as in eastern or western direction.

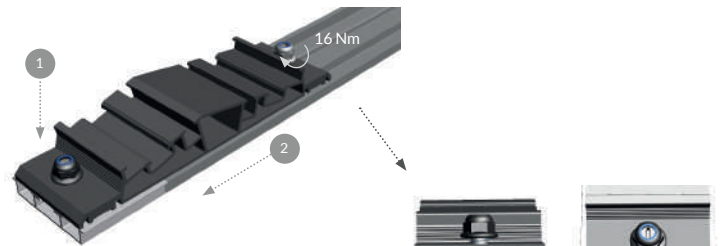


III. 5.1 - 1

III. 5.1 - 2

ASSEMBLY STEPS:

- Preassemble the short ground rails (60 mm) at the front foot.
- Push the next rail piece to the short rail piece without clearance and mount it with the front foot.
- Align the preassembled ground rails at right angles to the alignment line using a cord.
- The distance between the ground rails corresponds approximately to the module length. We recommend that you precisely realign this distance when assembling the modules.
- Screws not yet tightened (also identifiable by the vertical slot)
- Tightened screws (also identifiable by the horizontal slot)



III. 5.1 - 3



III. 5.1 - 4



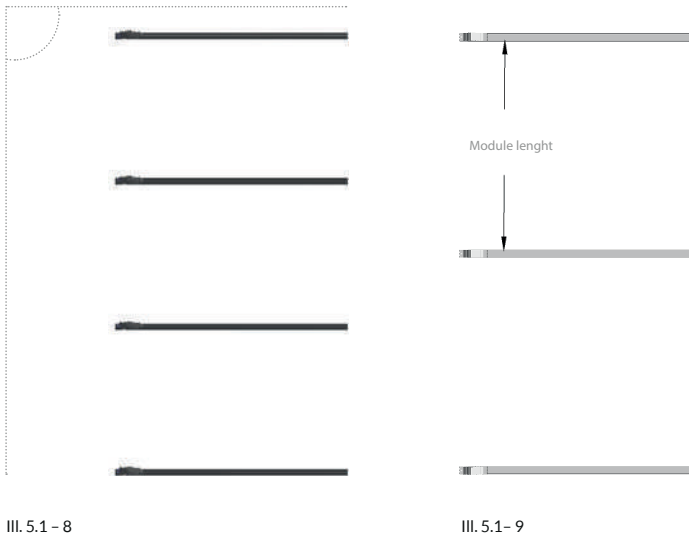
III. 5.1 - 5



III. 5.1 - 6



III. 5.1 - 7



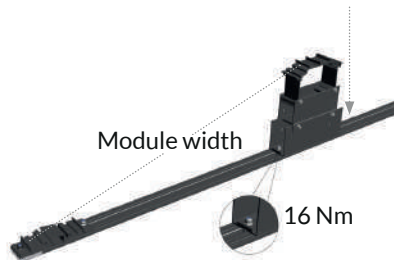
III. 5.1 - 8

III. 5.1 - 9

5.2. MOUNTING THE CENTRE SUPPORT

ASSEMBLY STEPS:

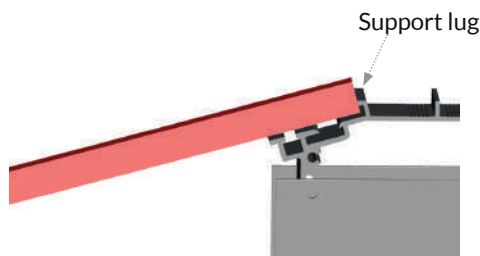
- The centre support is mounted using the supplied gauge. To this end, the gauge is placed between the two lugs.
- Tighten the centre support as well as the front foot on the ground rail.



III. 5.2 - 1



III. 5.2 - 2

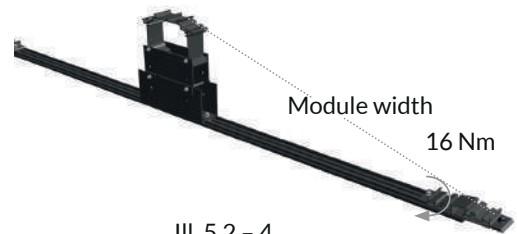


III. 5.2 - 3

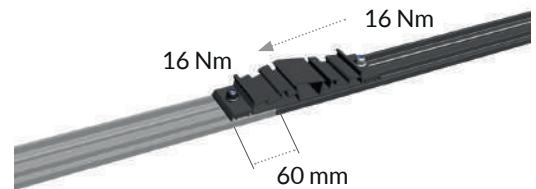
5.3. MOUNTING THE NEXT FRONT FOOT

ASSEMBLY STEPS:

- Push the next front foot onto the front ground rail. Align the distance between the centre support and the front foot with a gauge and tighten the front foot.
- Now mount the next ground rail (410 mm) without clearance and tighten the other side of the front foot at the ground rail.
- Align the next foot and mount it as described in 5.1.
- Repeat these steps until the mounting frame row is complete or until the rows are separated.
- Make sure that each mounting frame row ends with the short 60 mm ground rail so that the last front foot ends with this ground rail.
- Complete mounting frame row



III. 5.2 - 4



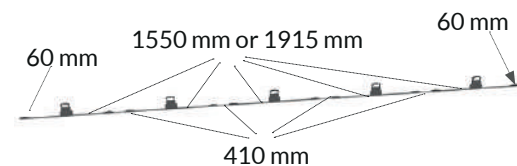
III. 5.2 - 5



III. 5.2 - 6



III. 5.2 - 7



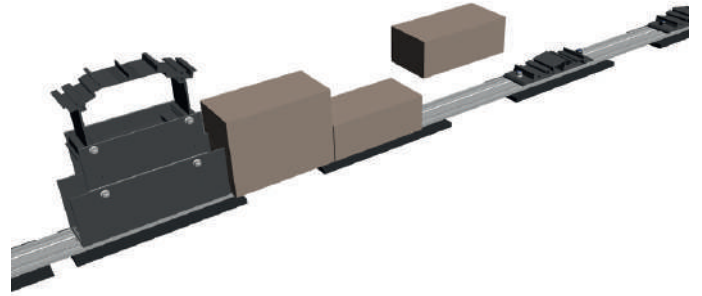
III. 5.2 - 8

MODULE LENGTH

Before finally mounting the modules, ballast must be applied. Depending on the height of the ballast, there are 3 variants for applying ballast to the Triangle E-W Pro system. All 3 variants as well as their assembly are presented in this chapter.

APPLYING BALLAST WITHOUT ADDITIONAL COMPONENTS

The ballast stones indicated in the ballast drawing are 200 x 100 x 80 mm cobblestones with a weight of 3.5 kg. These dimensions may vary slightly depending on the country.



III. 5.4 - 1

ASSEMBLY STEPS:

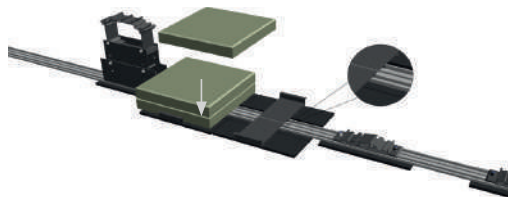
- Apply the ballast stones in the centre of the ground rail so that they do not get out of place.
- Depending on pitch and module width, only a limited number of ballast stones can be applied (see the following table):

CONFIGURATION	MODULE WIDTH	NUMBER OF COBBLESTONES ON THE GROUND RAIL
10°, narrow module	785-900 mm	2 (approx. 7 kg)
10°, wide module	900-1050 mm	4 (approx. 14 kg)
15°, narrow module	785-900 mm	4 (approx. 14 kg)
15°, wide module	900-1050 mm	8 (approx. 28 kg)

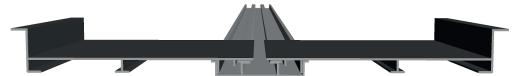
APPLYING BALLAST WITH ADDITIONAL BALLAST PROFILES

ASSEMBLY STEPS:

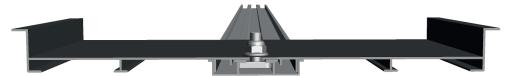
- Simply insert the ballast profiles in the ground rail. This variant also offers the option of using 30 x 30 cm paving stones in addition to the ballast stones.
- It is mandatory to apply building protection mats under the ballast profiles!
- When inserting the ballast profiles, make sure that both outer lugs of the ballast profiles are positioned in the outer channel of the ground rail.
- Two ballast profiles each are fitted at the ground rail using T-head bolts (only if paving stones are applied).
- Depending on pitch and module width, only a limited number of ballast stones can be applied (see the following table):



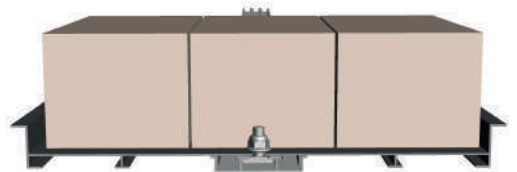
III. 5.4 - 2



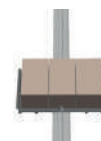
III. 5.4 - 3



III. 5.4 - 4



III. 5.4 - 5



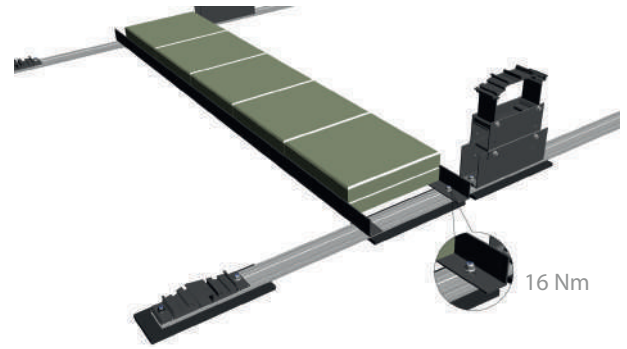
III. 5.4 - 6

CONFIGURATION	MODULE WIDTH	NUMBER OF COBBLESTONES ON THE GROUND RAIL AND BALLAST PROFILES
10°, narrow module	785-900 mm	6 (approx. 21 kg)
10°, wide module	900-1050 mm	12 (approx. 42 kg)
15°, narrow module	785-900 mm	14 (approx. 49 kg)
15°, wide module	900-1050 mm	24 (approx. 84 kg)

APPLYING BALLAST WITH ADDITIONAL L-PROFILES

ASSEMBLY STEPS:

- Preassemble T-head bolts and nuts at the L-profile.
- This variant also offers the option of using 30 x 30 cm paving stones in addition to the ballast stones.
- Flush mount the L-profile to the centre support.
- Irregularities can be adjusted with the long hole in the L-profile.
- Depending on pitch and module width, only a limited number of ballast stones can be applied (see the following table).



III.5.4 - 7

CONFIGURATION	MODULE WIDTH	NUMBER OF COBBLESTONES UNDER THE MODULE
10°, narrow module	785-900 mm	30 (approx. 105 kg)
10°, wide module	900-1050 mm	30 (approx. 105 kg)
15°, narrow module	785-900 mm	30 (approx. 105 kg)
15°, wide module	900-1050 mm	30 (approx. 105 kg)



III.5.5 - 1

5.5 MOUNTING THE MODULES

Clickstones are used for mounting the modules. Clickstones are special clips for fitting the module clamps in the rail channel. You only need an Allen wrench (5 mm) for assembly. You can insert the Clickstone into the rail channel from above. Each module end clamp can hold one module. The module clamp is positioned between two modules.

ASSEMBLY STEPS:

- Apply the module so that it rests on the supports by approx. 21.5 mm.
- Insert the Clickstone into the rail channel at a slightly slanted position.
- Press down the Clickstone and engage it in the rail until you hear a clicking sound.
- Tighten Allen screw with a torque of 8 Nm.

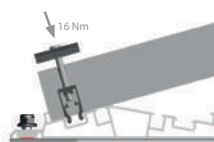
The lugs at the inside of the Clickstone are designed such that any mechanical release is ruled out once the screw has been tightened. So if you want to remove the Clickstone from the rail by pressing it together and lifting it up, you must first unscrew the Allen screw to above the lug.



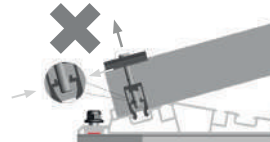
III.5.5 - 2



III.5.5 - 3



III.5.5 - 4



III.5.5 - 5



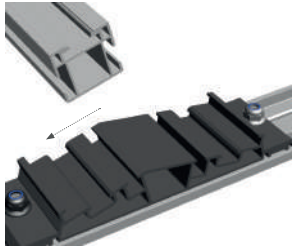
III.5.5 - 6

6. RAIL CLAMPING OF THE MODULES

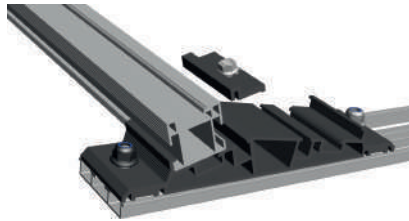
If the applied module is not approved for corner clamping, it must be clamped to the rail. Applying this variant, the module can be clamped to the quarter points of the long side.

To this end, some additional components must be installed:

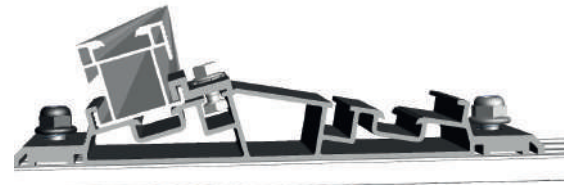
- base rail
- module support clamp
- inner connector



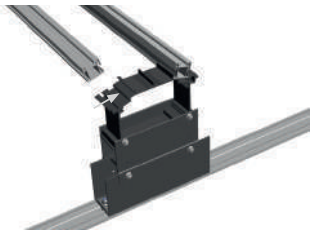
III. 6.1 - 1



III. 6.1 - 2



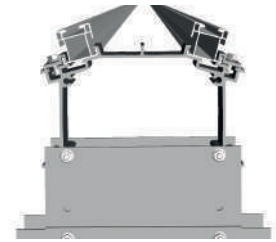
III. 6.1 - 3



III. 6.1 - 4



III. 6.1 - 5

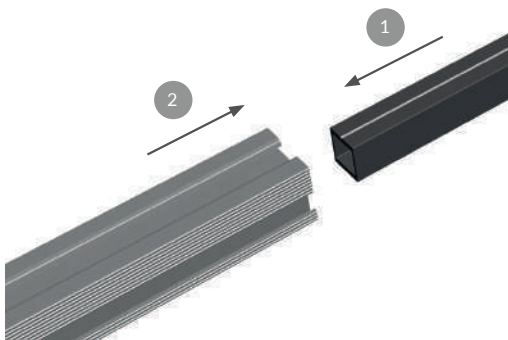


III. 6.1 - 6

6.2 ELONGATING THE RAILS

ASSEMBLY STEPS:

- Each rail can be elongated with the inner connector.
- To do so, you must insert the inner connector into the rail until the centre press cut touches the end of the rail, and then push the second rail until the press cuts are reached.



III. 6.2 - 1

6.1 MOUNTING THE RAIL

ASSEMBLY STEPS:

- First you must carry out the assembly steps 5.1 to 5.4.
- Apply the rails to the lugs of the front foot and the support.
- Attach the rail using the module support clamps. To do so, you must insert the module support clamp at the side of the support channel and insert it into the lug of the rail before tightening.

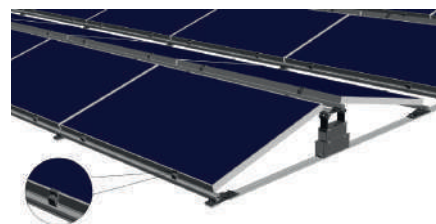
6.3 MOUNTING THE MODULES

Please also follow the assembly instructions in chapter 5.5.

For rail clamping, only module end clamps or laminate end clamps are used.

ASSEMBLY STEPS:

- Four module end clamp are used for each module which is clamped at the long side.
- When applying the module end clamps you must make sure to mind the clamping areas of the module which are specified by the module manufacturer in the module datasheet.



III. 6.3 - 1



III. 6.3 - 3



III. 6.3 - 2



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