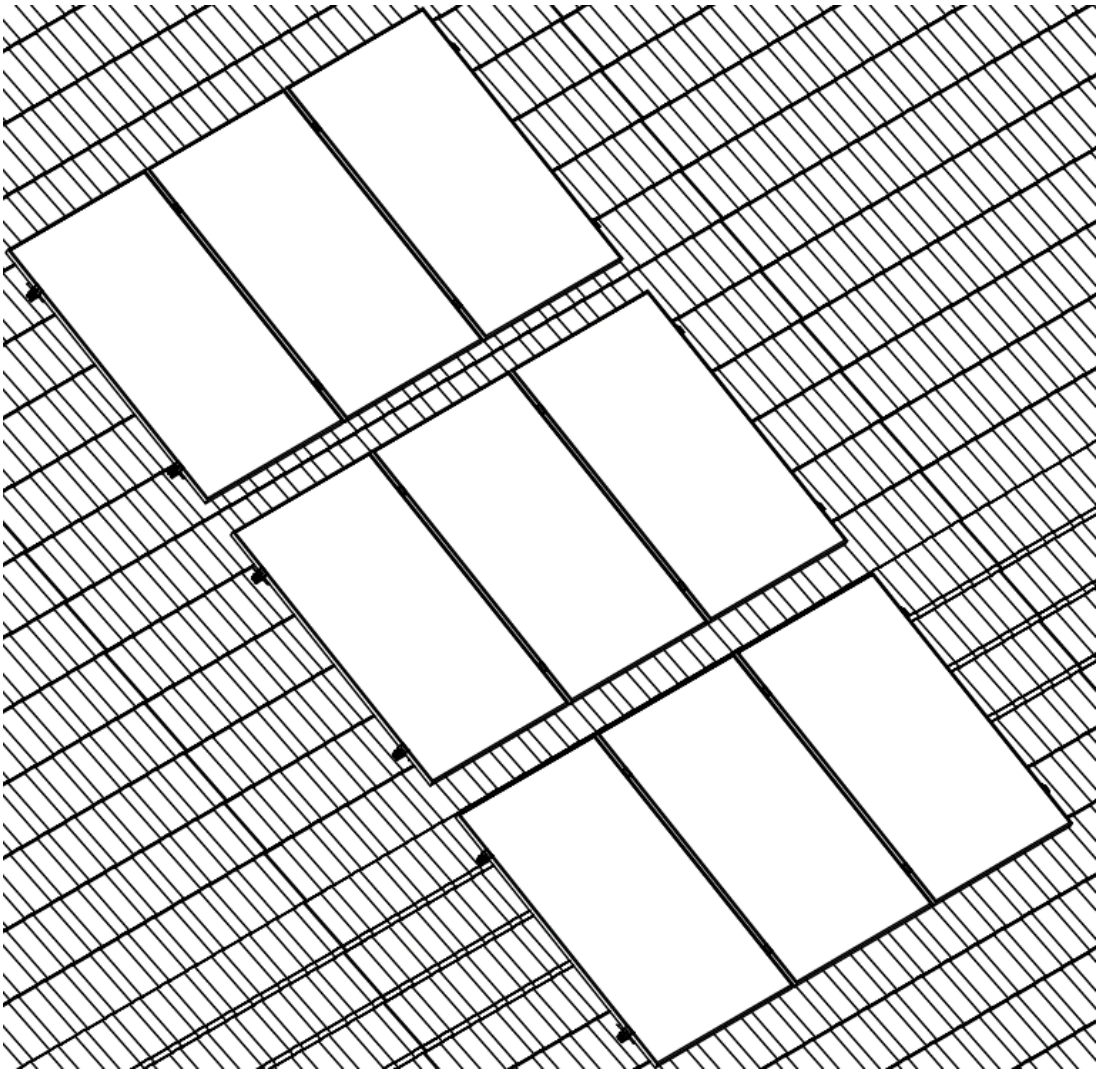
KENO
Sp. z o.o.

INSTALLATION MANUAL

STEEL HOOK K-15-R

MOUNTING SYSTEM



The STEEL HOOK K-15-R MOUNTING SYSTEM described below is used to mount photovoltaic modules on a pitched roof.

During production, every effort was made to provide you with a product of the highest quality which is also easy to mount. This instruction is a set of rules for the correct mounting of the mounting structure components but is not a blueprint or a substitute for it. The installer performing the mounting must be properly trained and licensed for the job. Overall responsibility for proper mounting rests with the installer who should select the appropriate type of construction.

In situations where the strength of the roof structure is questionable, a structural engineer should be consulted to perform strength calculations for the roof.

1. Technical data of construction:

Name	Value
The mounting system is compatible with a pitched roof covered	Double lap broken bond plain tile
Minimum pitch of the roof	35 degrees
Maximum pitch of the roof	45 degrees
Minimum size of photovoltaic module	1600 [mm] x 900 [mm] x 30 [mm]
Maximum size of photovoltaic module	2275 [mm] x 1140 [mm] x 35 [mm]
Compatible Solar Panel	Solar PV
Installation type	Above roof
System wind uplift resistance	382 [Pa]
Permissible panel orientation	Portrait, Landscape
Maximum surface photovoltaic modules of one row, mounted landscape	23,94 [m^2]
Maximum surface photovoltaic modules of one row, mounted portrait	47,8 [m^2]
Minimum cross section of wood rafter	60x60 [mm]
Minimum rafter edge distance for Wood screw K-16-60	25 [mm]

2. The layout of the modules shall be arranged to minimize or preclude the appearance of shadows on the modules. Keep in mind that even the shadow cast by trees or buildings can limit the yields generated by modules. When mounting the system in summer, be aware that the shadow cast by trees and neighboring buildings will reach much further in winter.

3. List of parts (example quantities for two modules).

Table 1. Modules mounted on the long side

Component image	Component Part Number	Component Name	Example Quantity	Comments
	K-15-R	Steel hook	6	**Group of elements K-15-R :** K-15-R-01, K-15-R-02, K-15-R-03, K-21. + K-19-25
	K-06-30	End clamp 30	4	*Depends on the thickness of the module frame
	K-06-35	End clamp 35		
	K-05	Mid clamp	2	
	K-21	Hexagon flange nut	6	
	K-19-25	“T” bolt 25	6	
	K-18-20	Hex socket cap screws 20	6	*Depends on the thickness of the module frame
	K-18-25	Hex socket cap screws 25		
	K-04	Feather	6	
	K-01-2220	Regular profile 2220	4840 [mm]	
	K-01-2400	Regular profile 2400		
	K-01-3540	Regular profile 3540		
	K-01-4400	Regular profile 4400		
	K-02	Profile connector	-	
	K-16-60	Wood screw 60	12	

Table 2. Modules mounted on the short side

Component image	Component Part Number	Component Name	Example Quantity	Comments
	K-15-R	Steel hook	10	**Group of elements K-15-R :** K-15-R-01, K-15-R-02, K-15-R-03, K-21. + K-19-25
	K-06-30	End clamp 30	4	*Depends on the thickness of the module frame
	K-06-35	End clamp 35		
	K-05	Mid clamp	2	
	K-21	Hexagon flange nut	10	
	K-19-25	“T” bolt 25	10	
	K-18-20	Hex socket cap screws 20	6	*Depends on the thickness of the module frame
	K-18-25	Hex socket cap screws 25		
	K-04	Feather	6	
	K-01-2220	Regular profile 2220	9380 [mm]	
	K-01-2400	Regular profile 2400		
	K-01-3540	Regular profile 3540		
	K-01-4400	Regular profile 4400		
	K-02	Profile connector	2	
	K-16-60	Wood screw 60	20	

4. Required tools for installing Steel Hook K-15-R Mounting System.

Tool image	Tool name	Usage
	Cordless drill	K-16-60, K-18-20, K-18-25, K-21
	Socket 15mm	K-21
	Hex bit 6	K-18-20, K-18-25
	Torx bit T40	K-16-60
	Measure tape	K-15-R, K-01-2200/ 2400/3540/4400
	Torque spanner	K-18-20, K-18-25, K-21
	Angle grinder	Tiles

5. The length of one row of modules can be calculated using the two formulas described below.
ATTENTION: Maximum row length - 21 [m].

a. Formula for row mounted on short side (landscape):

ROW LENGTH = NUMBER OF MODULES IN THE ROW * MODULE + 20mm) + 60mm

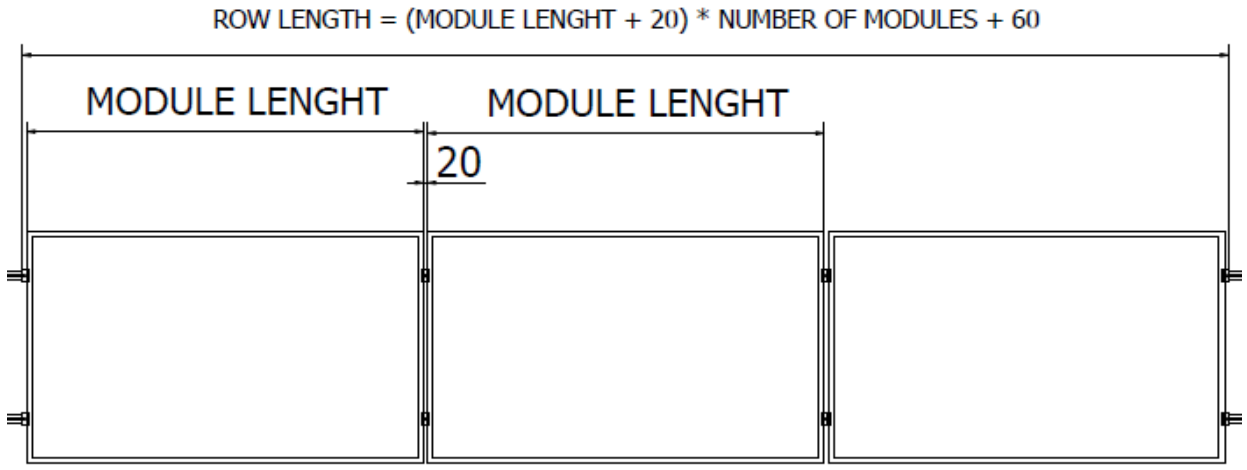


FIGURE 1 Construction row length for short side mounted modules.

Maximum surface photovoltaic modules of one row, mounted landscape

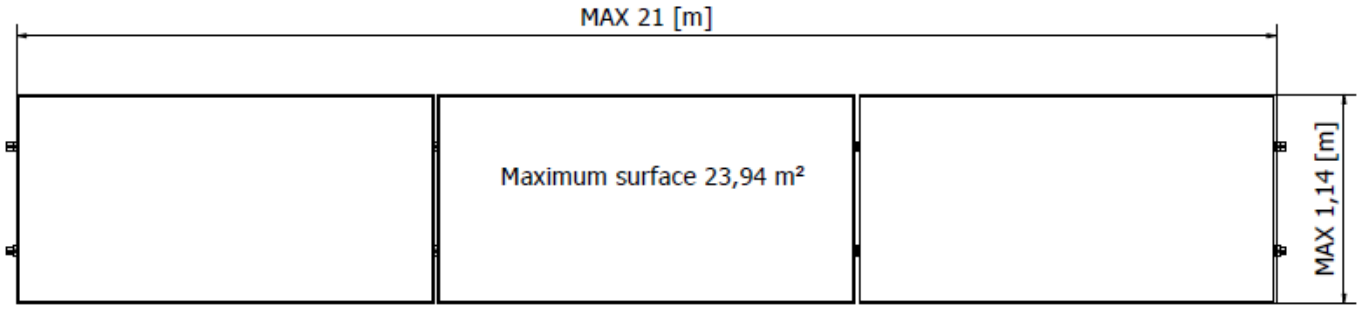


FIGURE 2 Maximum surface photovoltaic modules of one row, mounted landscape.

b. Formula for a row mounted on the long side (portrait):

ROW LENGTH = NUMBER OF MODULES IN THE ROW * (MODULE + 20mm) + 60mm

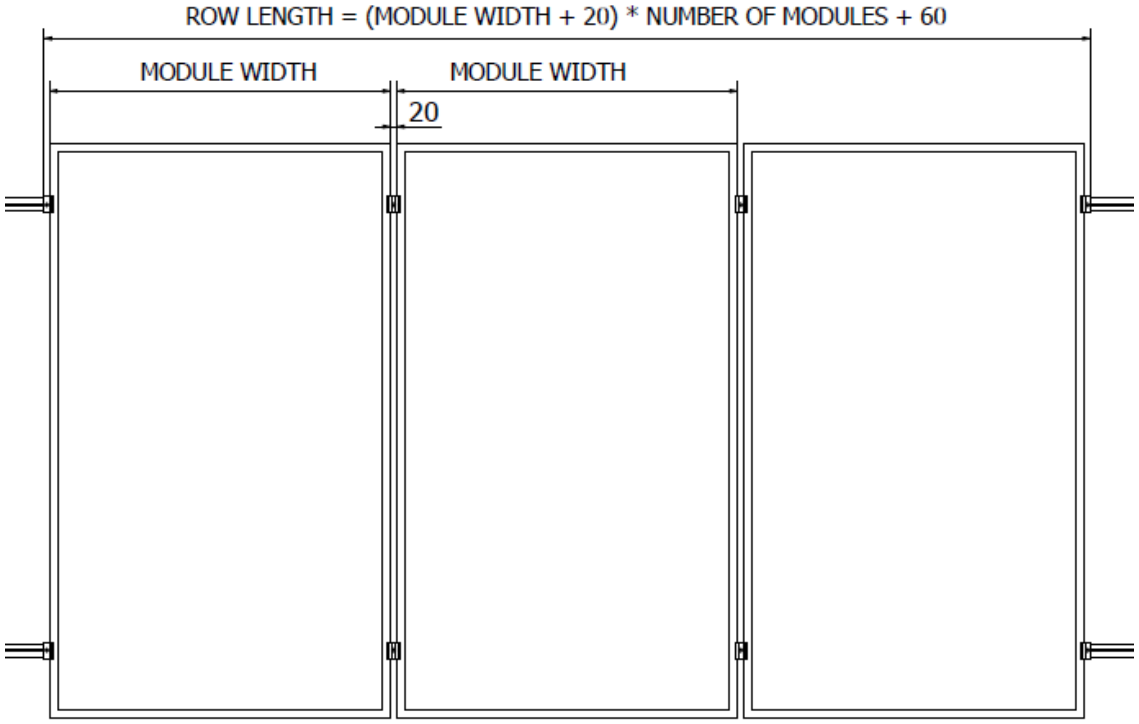


FIGURE 3 Length of the row of structures mounted on the long side.

Maximum surface photovoltaic modules of one row, mounted portrait

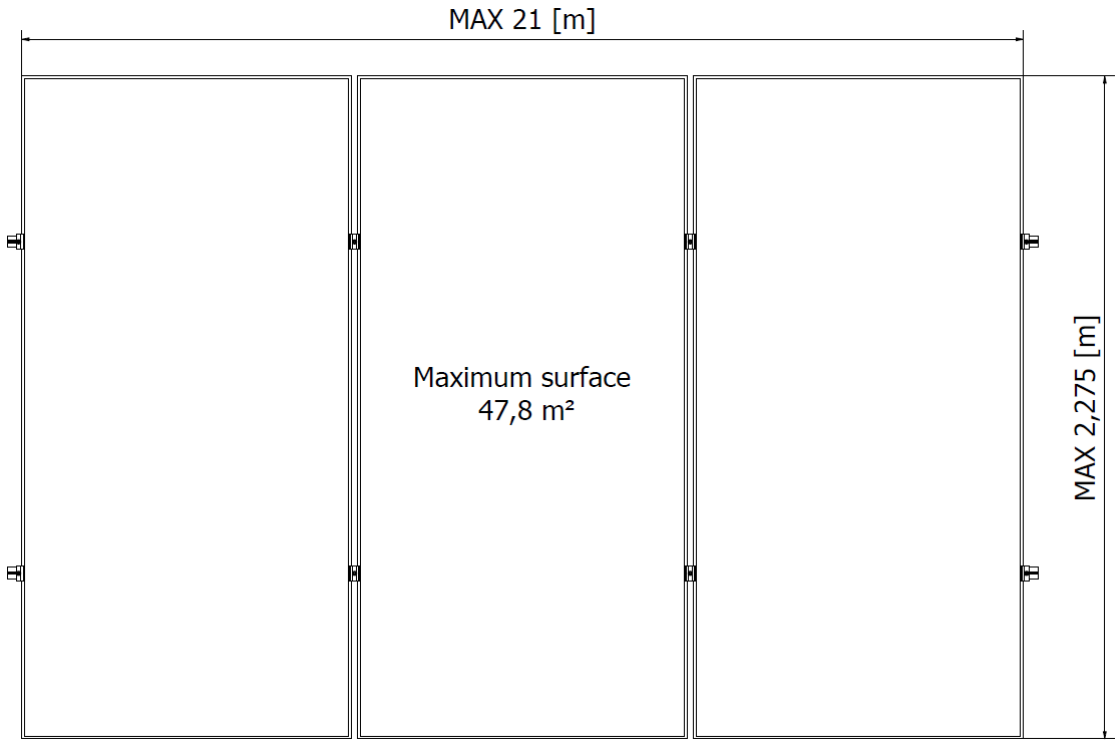


FIGURE 4 Maximum surface photovoltaic modules of one row, mounted portrait.

6. Minimum distance regular profile K-01-2220/2400/3540/4400 from the edge of module to the center of the module clamps.
ATTENTION: Check module pv manual installation, module manufacturer.

a. For long-side mounting

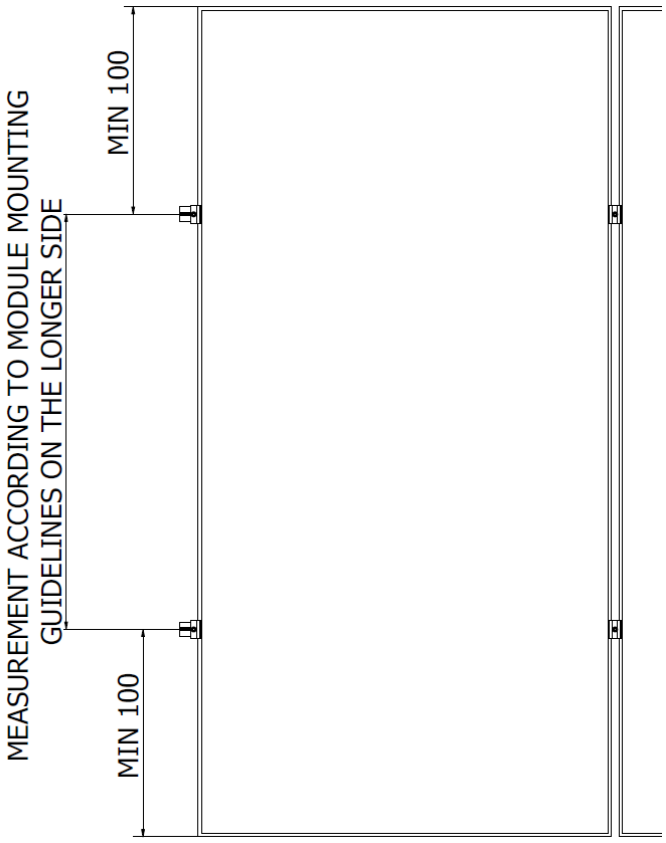


FIGURE 5 Dependence of the edge of module to the center of the module clamps

b. For mounting on the short side

FIGURE 6 Dependence of the edge of module to the center of the module clamps

7. The spacing between the mounting points depends on the size of module photovoltaic and the method of mounting it. The dimensions given in Table 3 and Table 4 are the maximum dimensions.

ATTENTION: Hooks must not be climbed on or used as a means of support by installers. Check module pv manual installation, module manufacturer.

a. For long-side mounting

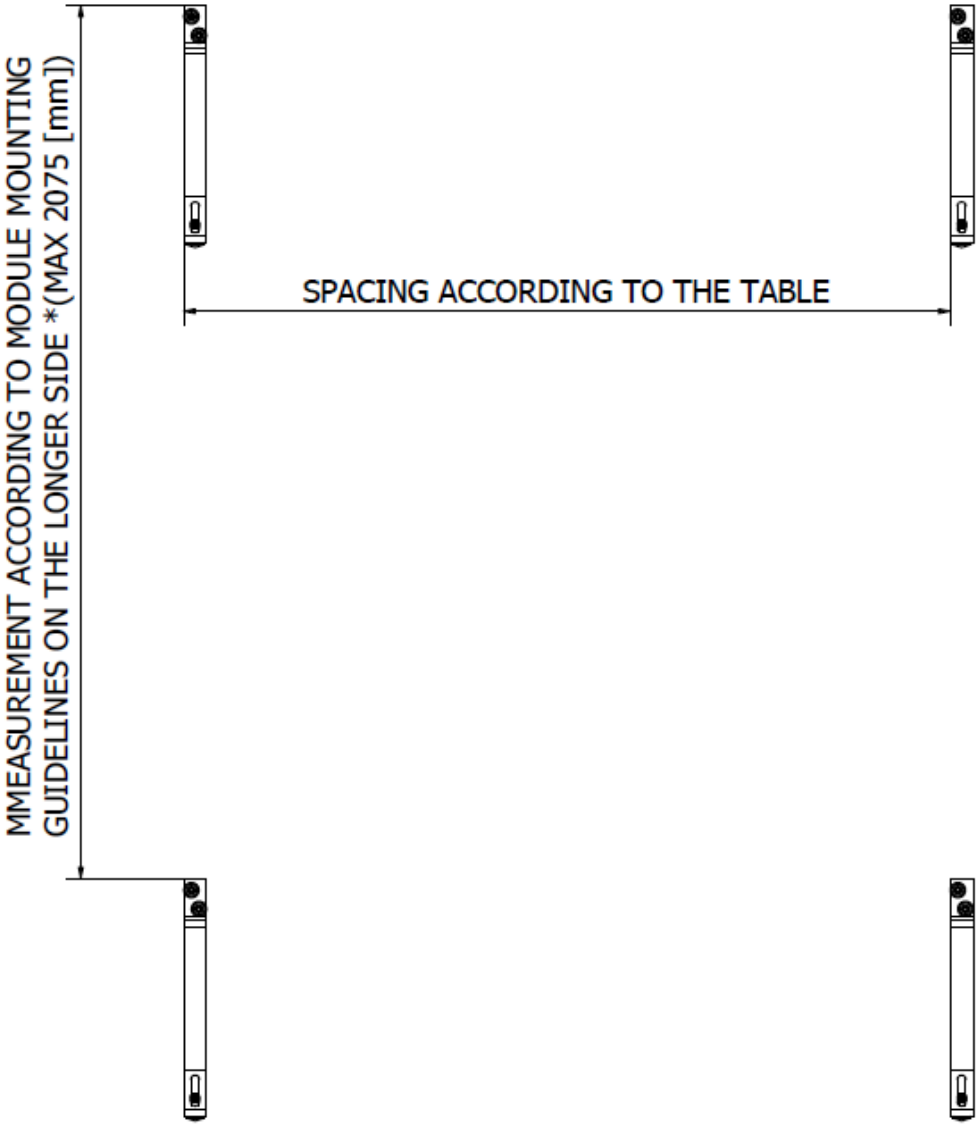


FIGURE 7 Bracket spacing

Table 3 Maximum spacing of brackets

Module length - X	Module width - X	K-01
X ≤ 1780 [mm]	**X** ≤ 1052 [mm]	1.2 [m]
1780 [mm] < **X** ≤ 2275 [mm]	1052 < **X** ≤ 1140 [mm]	1.1 [m]

b. For mounting on the short side

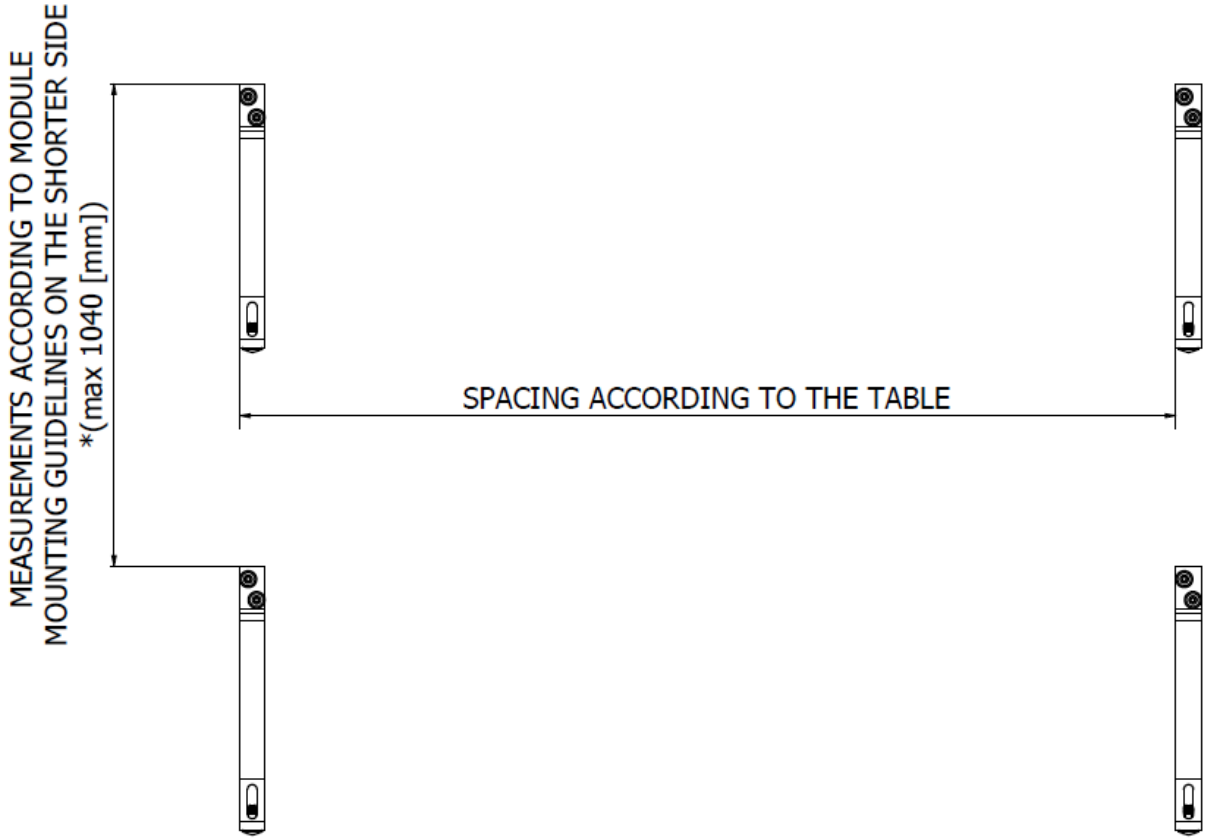


FIGURE 8 Bracket spacing

Table 4 Maximum spacing of brackets

Module length - X	Module width - X	K-01
X ≤ 1780 [mm]	**X** ≤ 1052 [mm]	1.2 [m]
1780 [mm] < **X** ≤ 2275 [mm]	1052 < **X** ≤ 1140 [mm]	1.1 [m]

ATTENTION: Maintain a gap of at least 20mm from the edge of the profile to the beginning of the End clamp 30/35, and maximum 300mm from Steel Hook K15-R (fig.9).

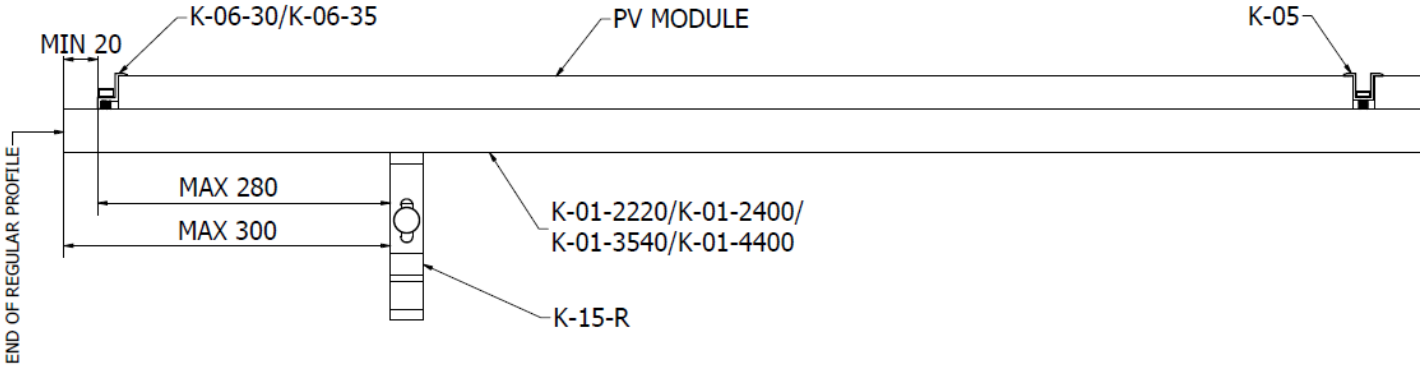


FIGURE 9 Dependence of the End clamp K-06-30/35 and Steel Hook K-15-R on the end of Regular profile K-01-2220/2400/3540/4400

8. Ways to install hooks on the roof rafters. First of all, it is necessary to remove selected tiles, allowing access to the rafters. The mounting bracket should be applied to the rafter and fixed with a two K-16-60 wood screws (without pre-drilling).
ATTENTION: The design of the K-15-R bracket requires the installer to additional, necessary tile grinding with appropriate angle grinder which should be done so that there are no gaps between the roof tile and the hook.

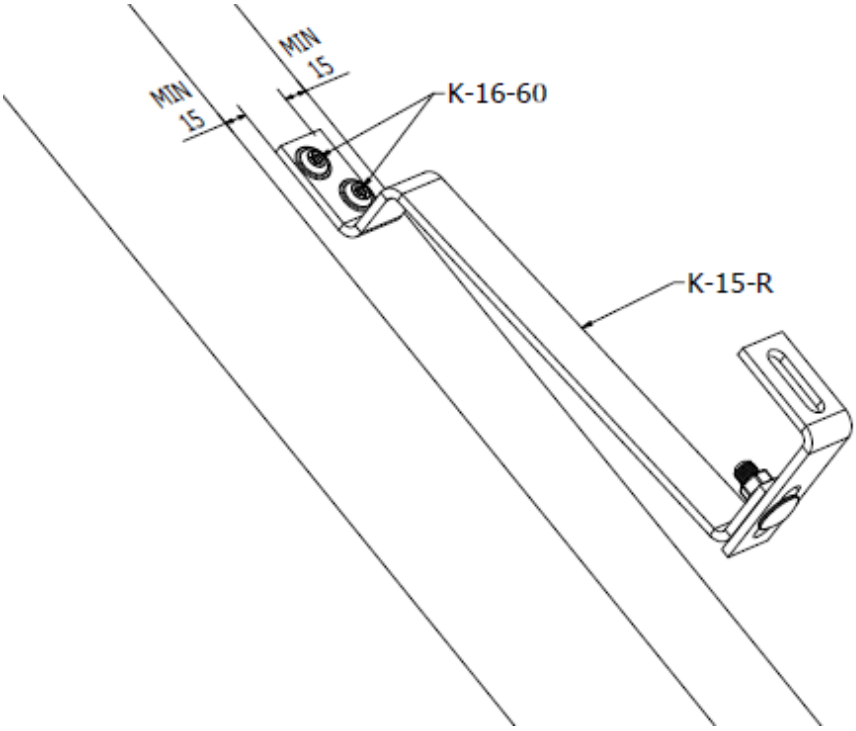


FIGURE 10 Mounting of the K-15-R bracket

Lack of gaps between the tile and the steel hook.

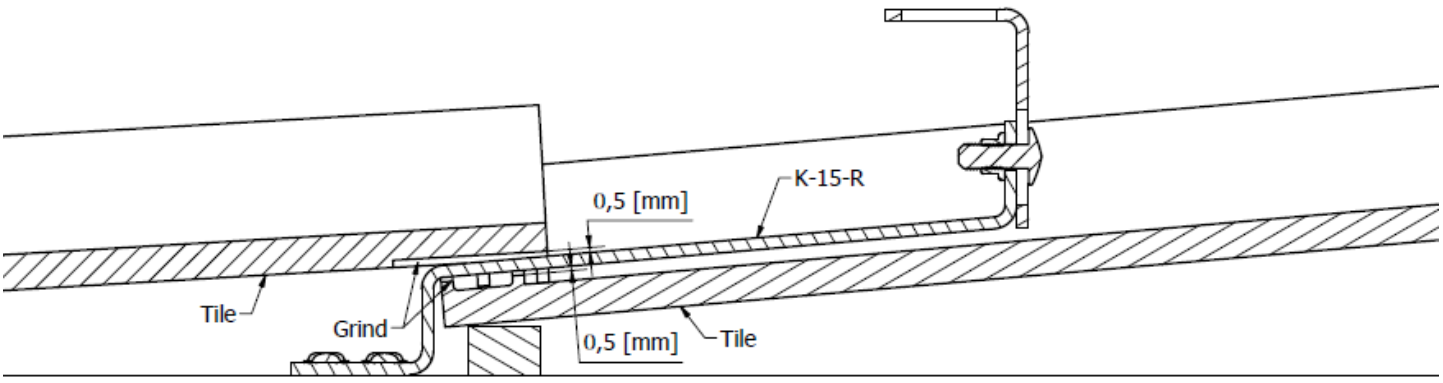


FIGURE 11 Tile grinding

9. After mounting the K-15-R hook, ensure that the hook is in the correct position, i.e. the bracket **does not** protrude below the plane of the hook base- pre-tighten (fig.12,13.)

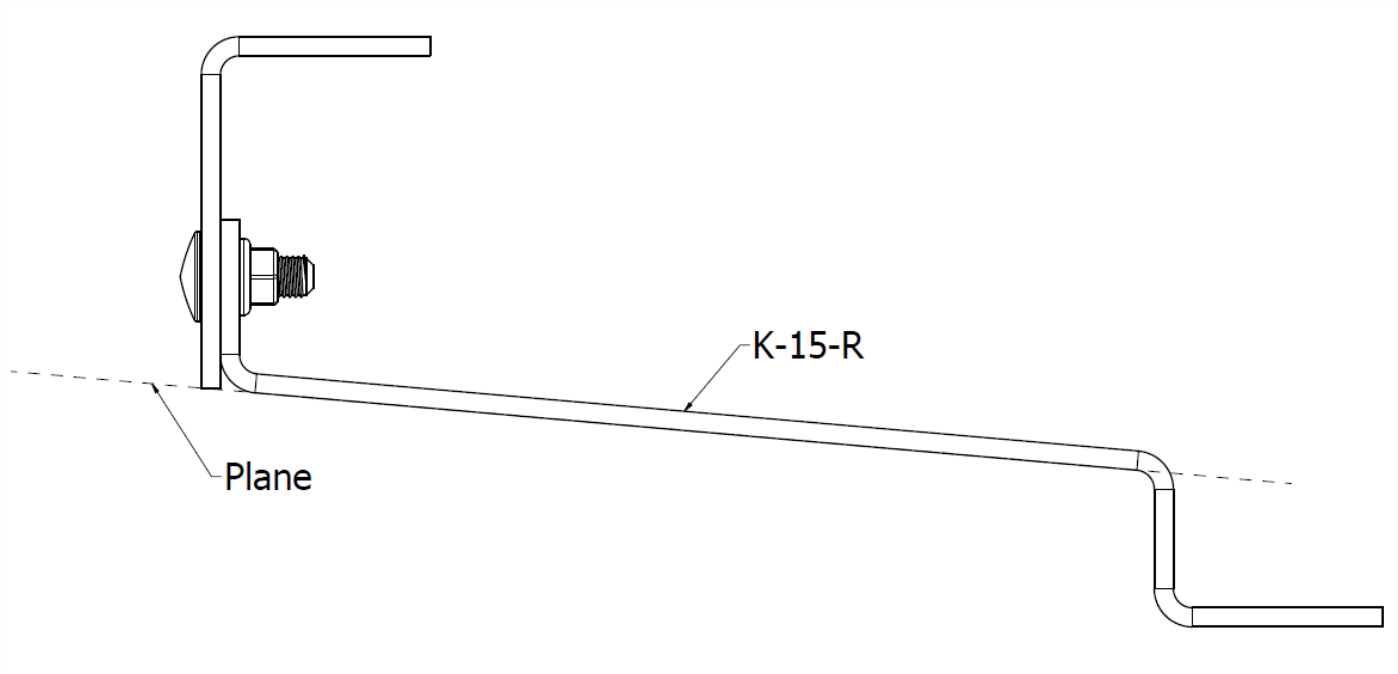


FIGURE 12 Hook positioned at minimum height

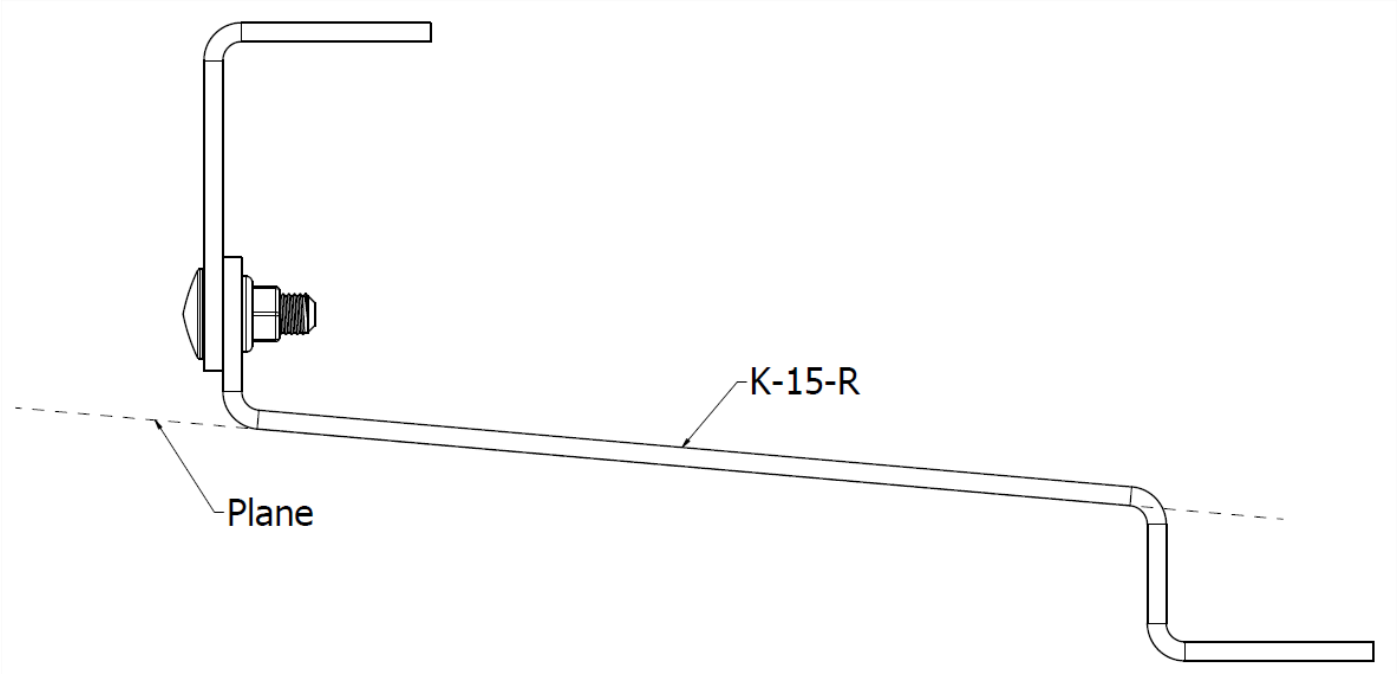


FIGURE 13 Hook positioned at maximum height

10. After mounting the brackets, prepare the mounting profiles by connecting them to the appropriate length using the K-02 fasteners by placing them on the ends of two adjacent profiles. Twist the connector using two "T" bolts 25 (fig.14). Profiles can be cut to the required length. **Tighten fasteners 30Nm.**
ATTENTION: The minimum useful length of the profile in the mounting system is 500mm.

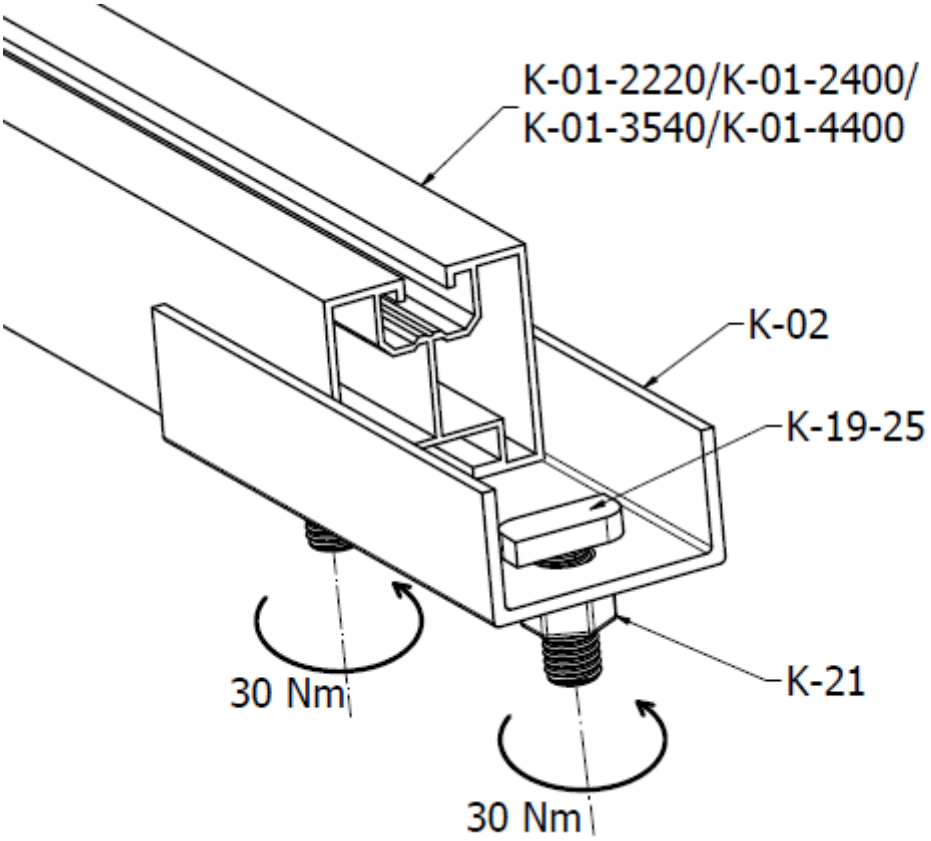


FIGURE 14 Mounting of the K-02 connector

ATTENTION: The minimum distance of the clamp from the connector is 200mm.

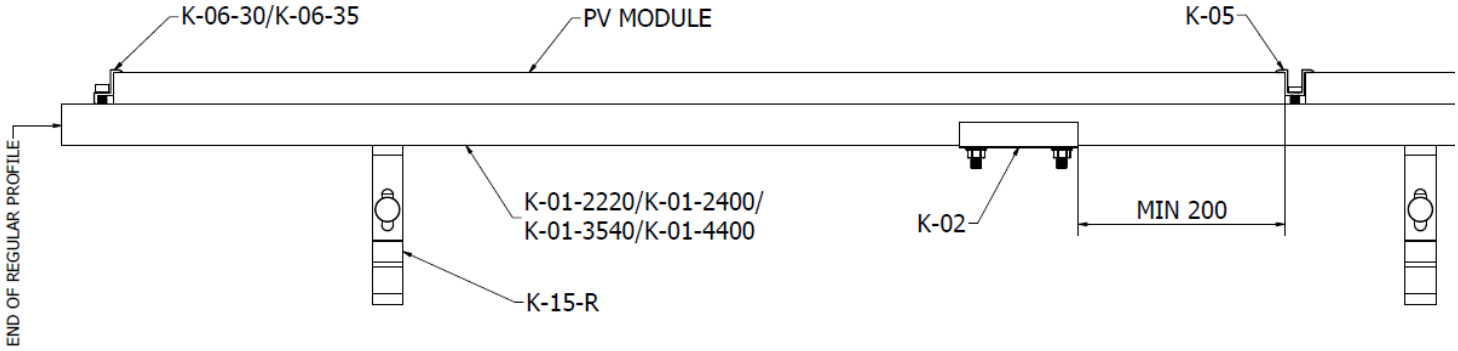


FIGURE 15 Dependence of the clamp on the connector

11. The prepared profiles should be attached to the installed hooks using "T" bolts 25. The heads of the ”T” bolts must go into a specially designed channel through the “bean” type holes in themounting bracket.

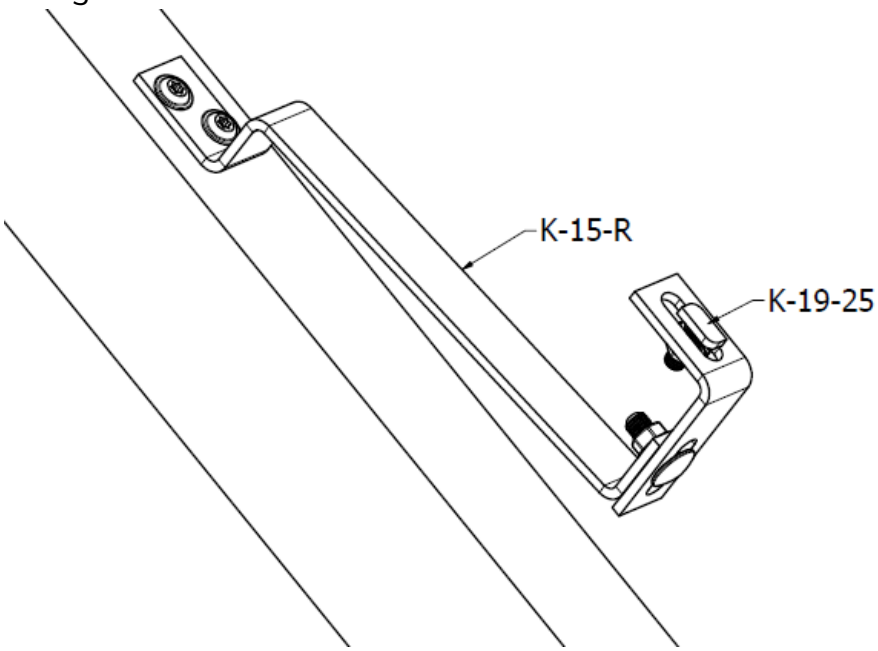


FIGURE 16 Mounting of "T" bolts 25

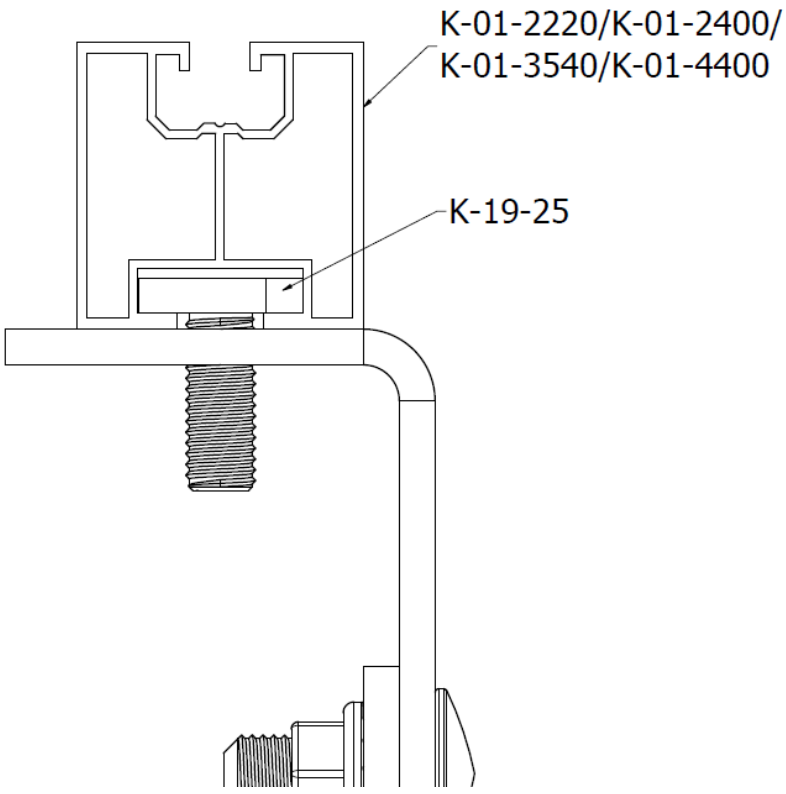


FIGURE 17 Mounting of profile K-01-2220/2400/3540/4400

12. Thread the hexagon flange nut K-21 onto the protruding threads from the "T" bolts 25 (K-19-25) . **Tighten fasteners 30Nm.**

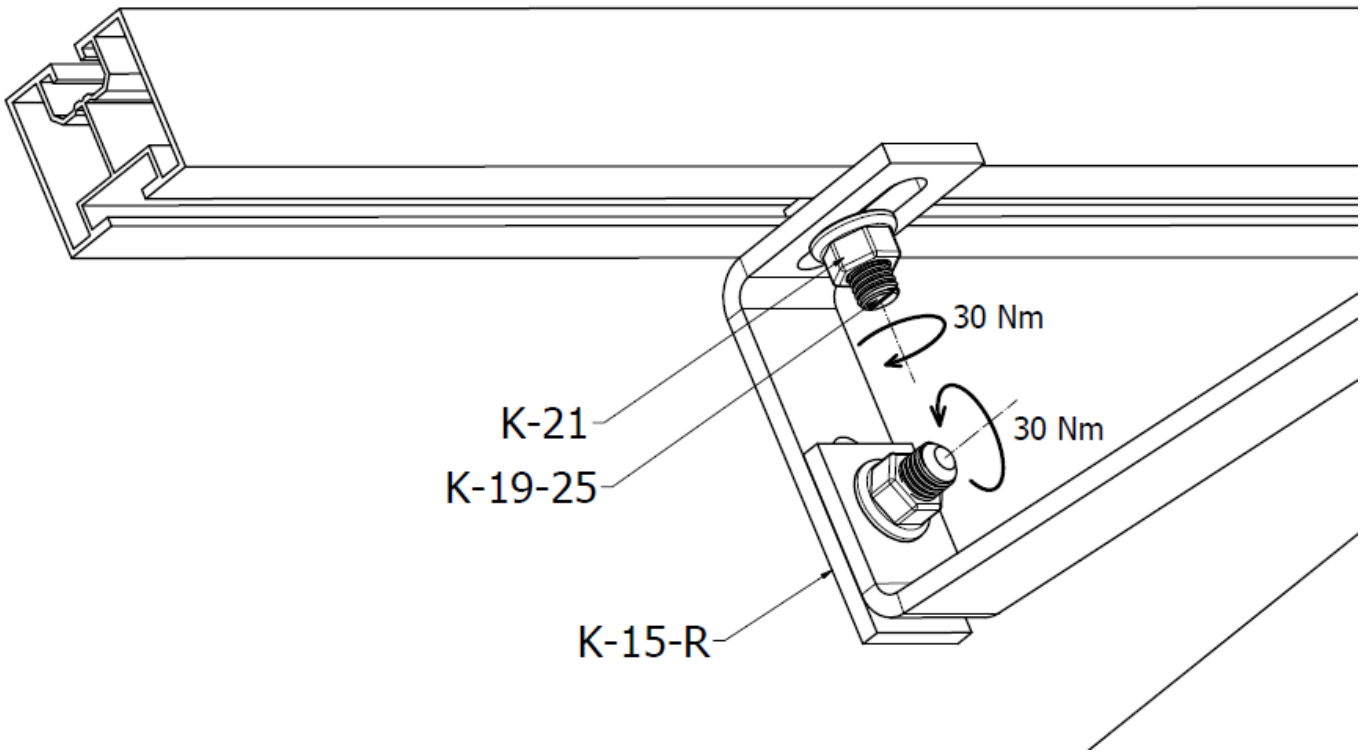


FIGURE 18 Mounting of "T" bolts 25

13. The feather K-04 can be mounted in a specially prepared channel. It can be mounted in any desired location.

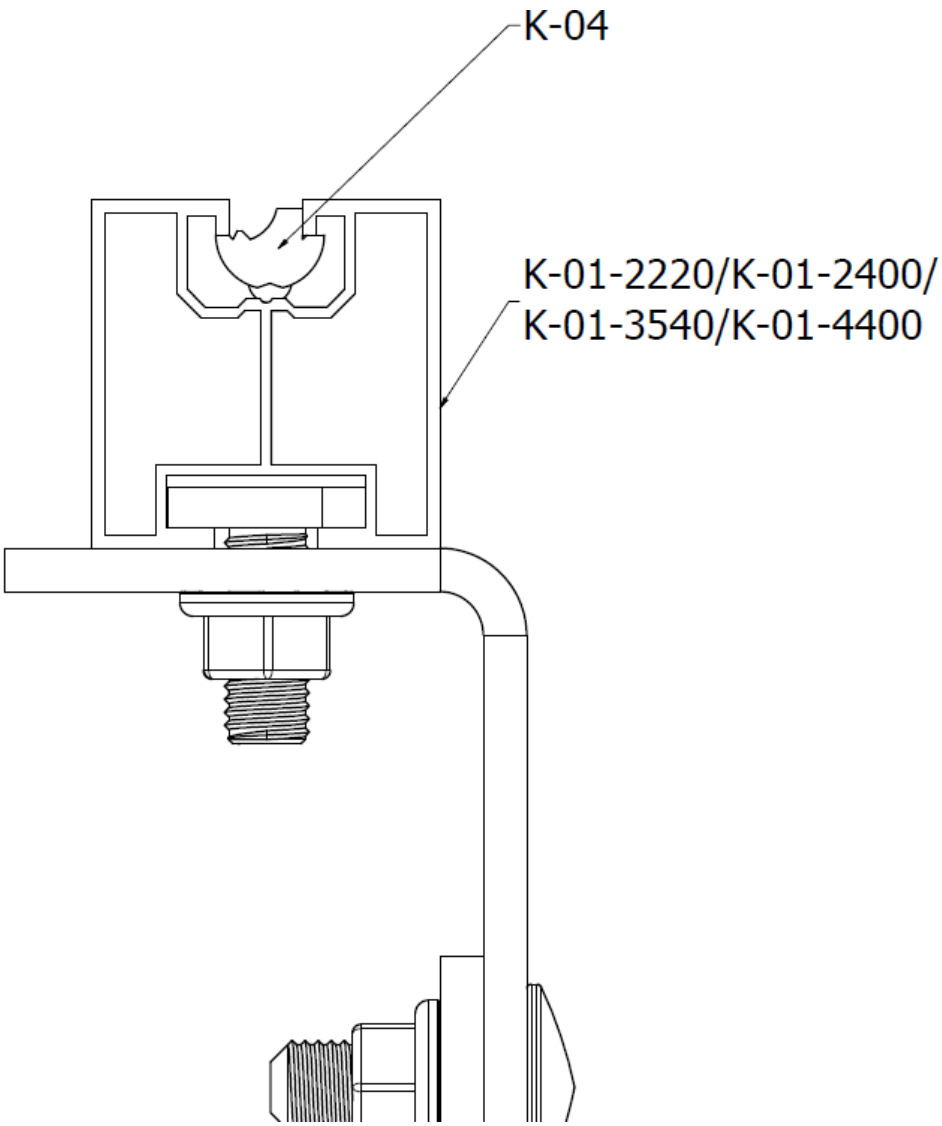
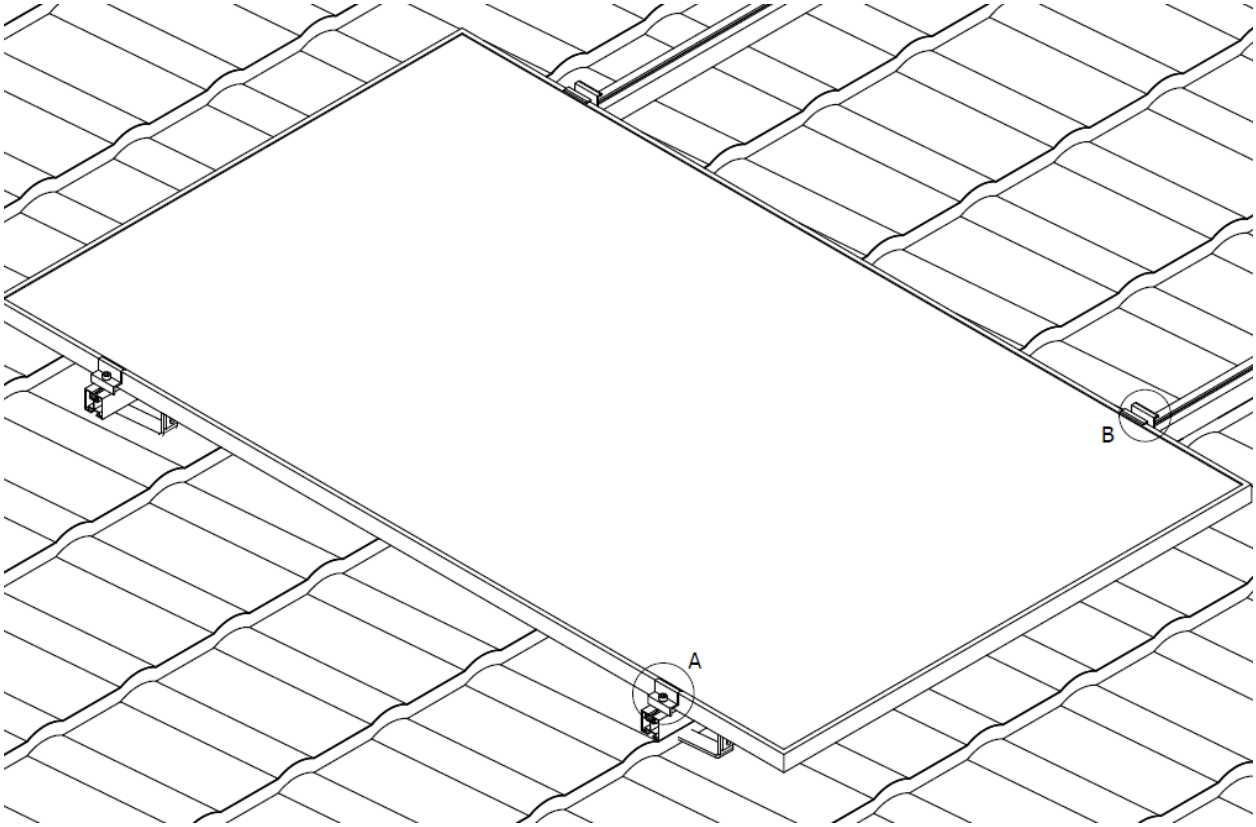
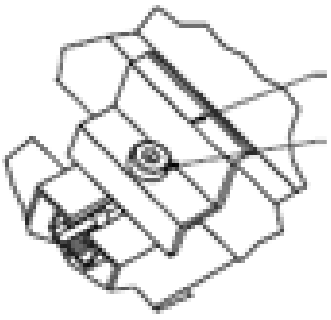


FIGURE 19 Mounting of the K-04 nut to K-01 profiles

14. Then insert the end clamps K-06-30 or K-06-35 *(*depending on the thickness of the module frame, for a 30mm thick frame use end claps 30, for a 35mm thick frame use end claps 35) into the first regular profile (K-01-2220/2400/3540/4400)* with the hex socket cap screws K-18-20 or K-18-25 *(*depending on the thickness of the module frame, for a 30mm thick frame use K-18-20, for a 35mm thick frame use K-18-25)*. The first from the edge and the last from the edge will always be the end clamp K-06-30 or K-06-35 *(*depending on the thickness of the module frame)* , stabilizing the edge ofthe first and the last module in a row. The mid-clamps K-05, on the other hand, will simultaneouslystabilize the sides of the two modules.

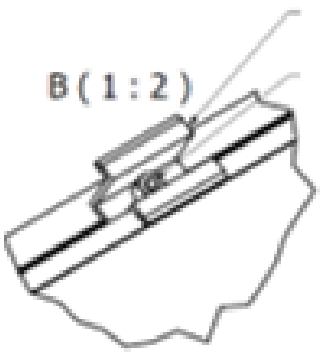


A (1 : 2)



K-06-30/K-06-35
K-18-20/K-18-25

B (1 : 2)



K-05
K-18-20/K-18-25

FIGURE 20 *Mounting of the modules and mounting the K-05 and K-06-30/35 clamps*

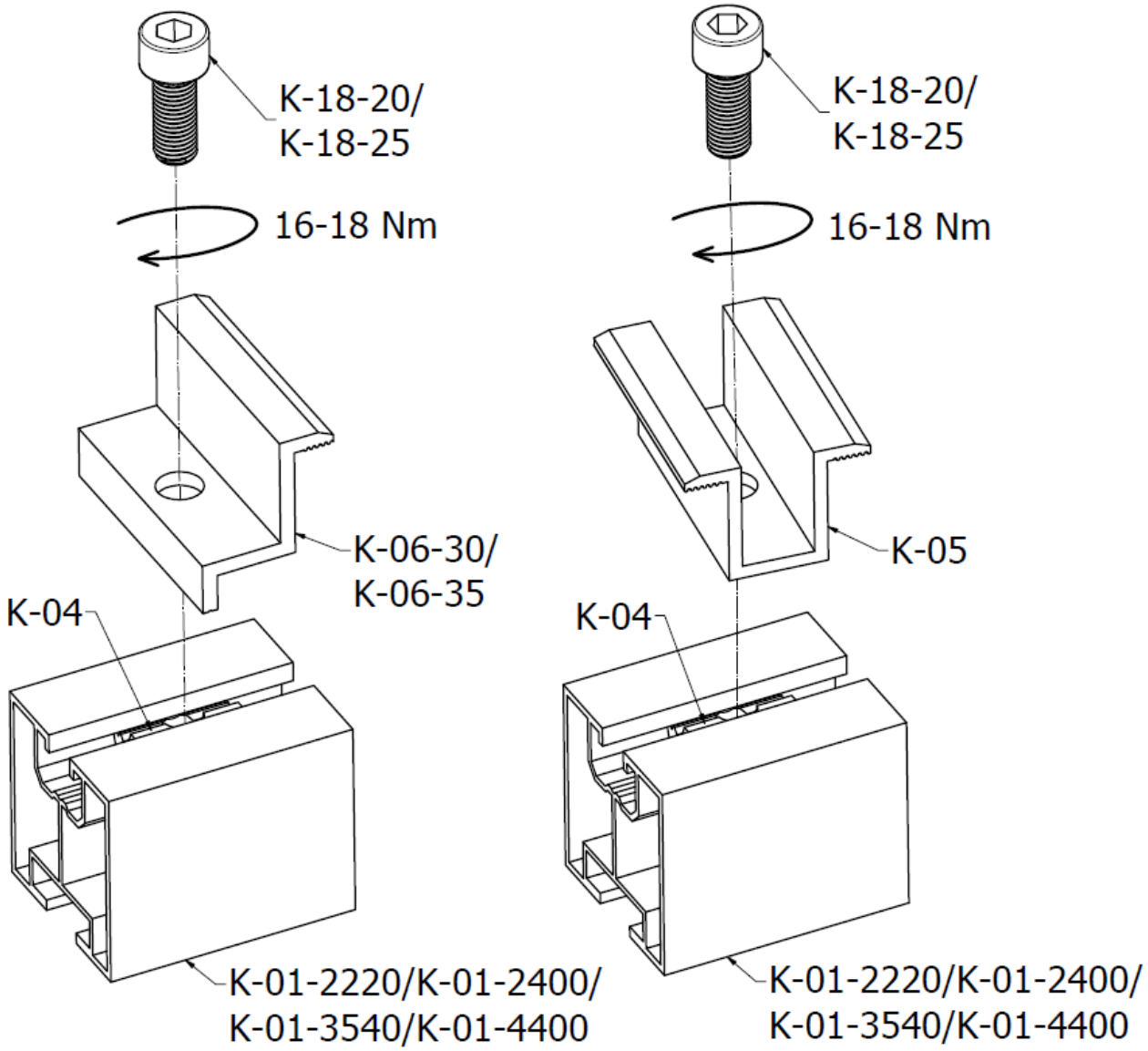


FIGURE 21 Mounting the K-05 and K-06-30/35 clamps

15. Tighten all hex socket cap screws *16-18Nm **(according to the installation instructions of the manufacturer of the selected PV module).**

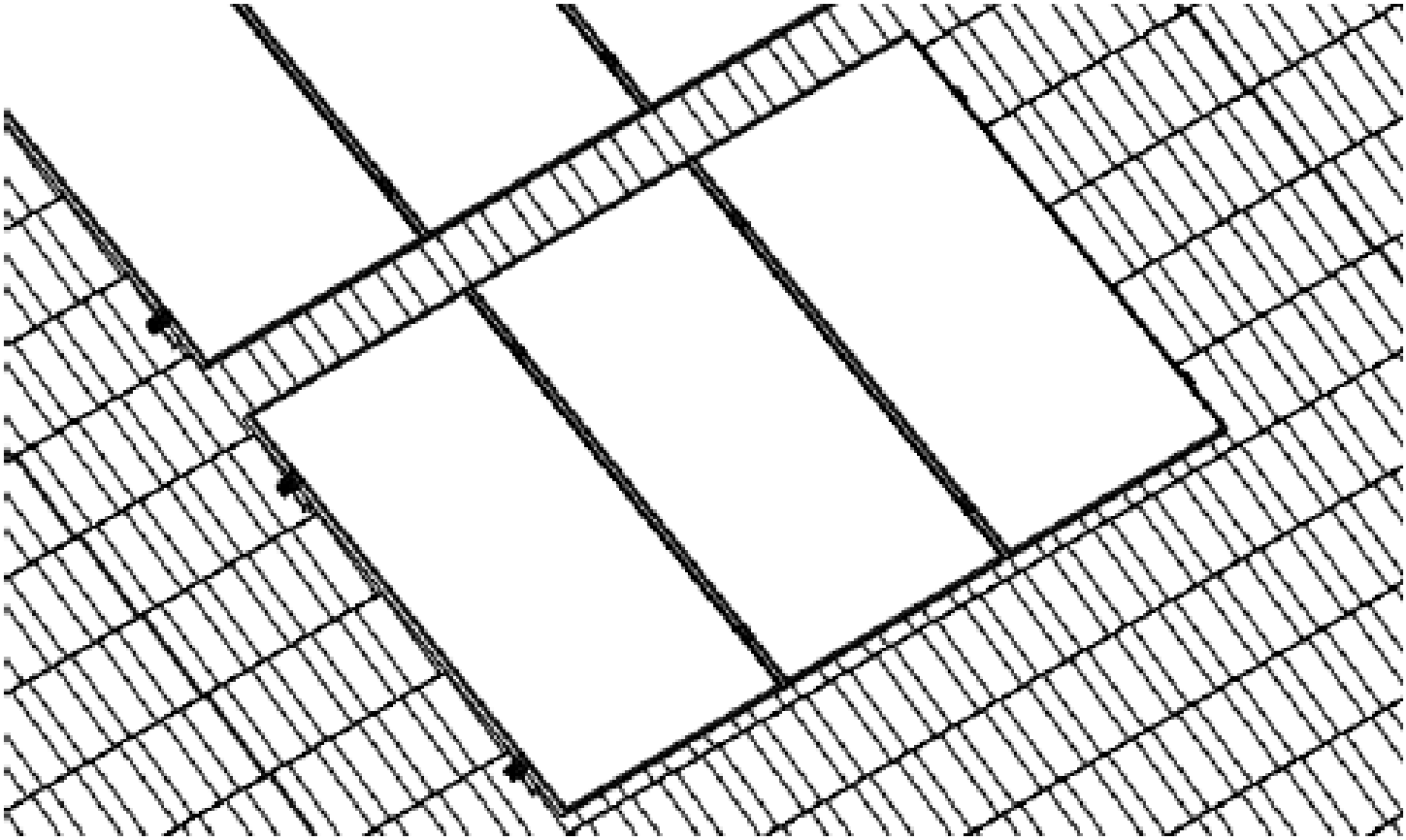


FIGURE 22 Viev of assembled mounting system with modules

16. The system shall be serviced according to the schedule given in Table 5.

Table 5 SERVICE INSPECTION REPORT

INSPECTION AFTER 1ST YEAR		**INSPECTION AFTER 4TH YEAR**	
DATE OF INSPECTION		DATE OF INSPECTION	
INSPECTOR (name, Vat No., address)		INSPECTOR (name, Vat No., address)	
☐ verification of bolt tightness ☐ visual verification of the condition of the mounting system ☐ verification of rubber components (if applicable) ☐ verification of cleanliness status		☐ verification of bolt tightness ☐ visual verification of the condition of the mounting system ☐ verification of rubber components (if applicable) ☐ verification of cleanliness status	
ADDITIONAL COMMENTS			
INSPECTION AFTER 8TH YEAR		**INSPECTION AFTER 12TH YEAR**	
DATE OF INSPECTION		DATE OF INSPECTION	
INSPECTOR (name, Vat No., address)		INSPECTOR (name, Vat No., address)	
☐ verification of bolt tightness ☐ visual verification of the condition of the mounting system ☐ verification of rubber components (if applicable) ☐ verification of cleanliness status		☐ verification of bolt tightness ☐ visual verification of the condition of the mounting system ☐ verification of rubber components (if applicable) ☐ verification of cleanliness status	
ADDITIONAL COMMENTS		ADDITIONAL COMMENTS	

Thank you for using KENO Sp z o.o. construction

Contact

Technical support

+48 32 341 71 71 ext. 2

serwis@keno-energy.com

KENO Sp. z o.o.

NIP PL6312671983

KRS 0000688578

biuro@keno-energy.com

tel. +48 32 341 71 71

www.keno-energy.com