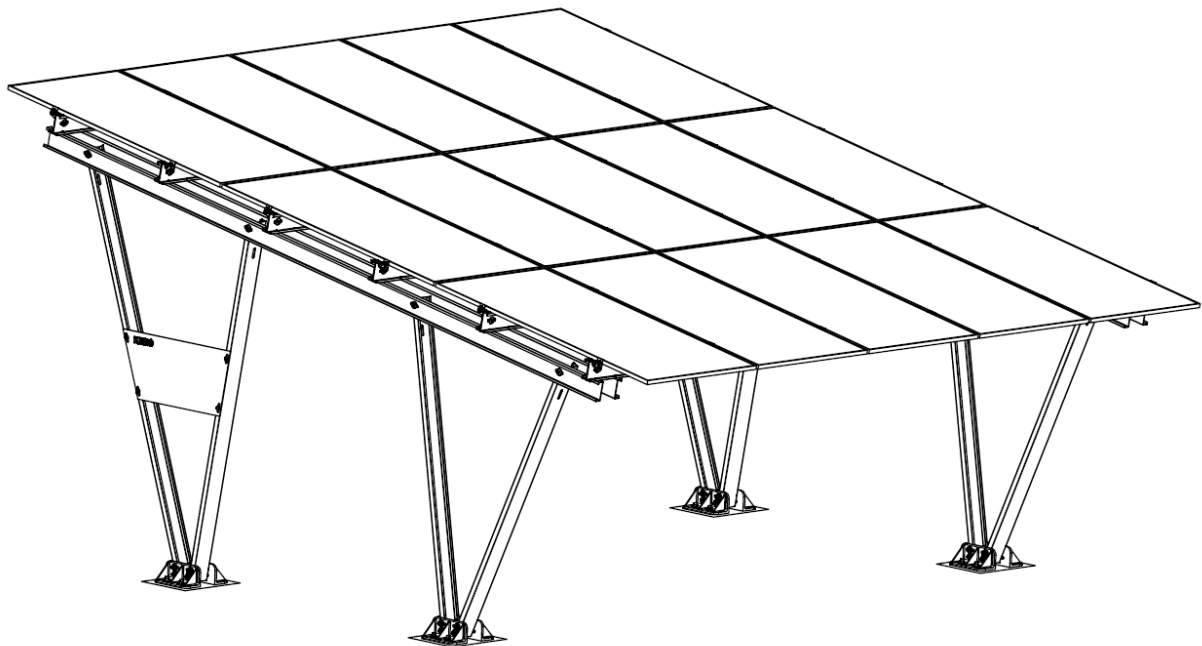




# ASSEMBLY INSTRUCTIONS

## CARPORT STRUCTURE

### W-01-00



- Before carrying out assembly work, verify that the assembly site is located in:
  - wind load zone 1 or 3, up to a height of 300 m ASL (according to PN-EN 1991-1-4:2008),
  - snow load zone 1, 2 or 3 (according to PN-EN 1991-1-3:2005).
 Modules of the following size and weight can be fitted on the carport: length: 2000–2278 [mm] x max. width: 1134 [mm], max. weight: 35 [kg].
- The foundations must be prepared in previously excavated trenches in accordance with the drawing below (use at least C20/25 grade concrete, as per EN 13791). The foundations must have 4 threaded rods (M20x1000, galvanised, min. grade 8.8, or A2-70 stainless steel). The rods must be connected according to the same principles as foundation reinforcement. At this stage, it is advisable to provide earthing in the form of an earthing spike if the required earthing is unavailable. It is also necessary to route the wires around the mounting plate on which the device (inverter/charger) will be fitted. Provide a PE cable, an AC connection cable, as well as two Ethernet cables for possible communication with the energy meter and the Internet.

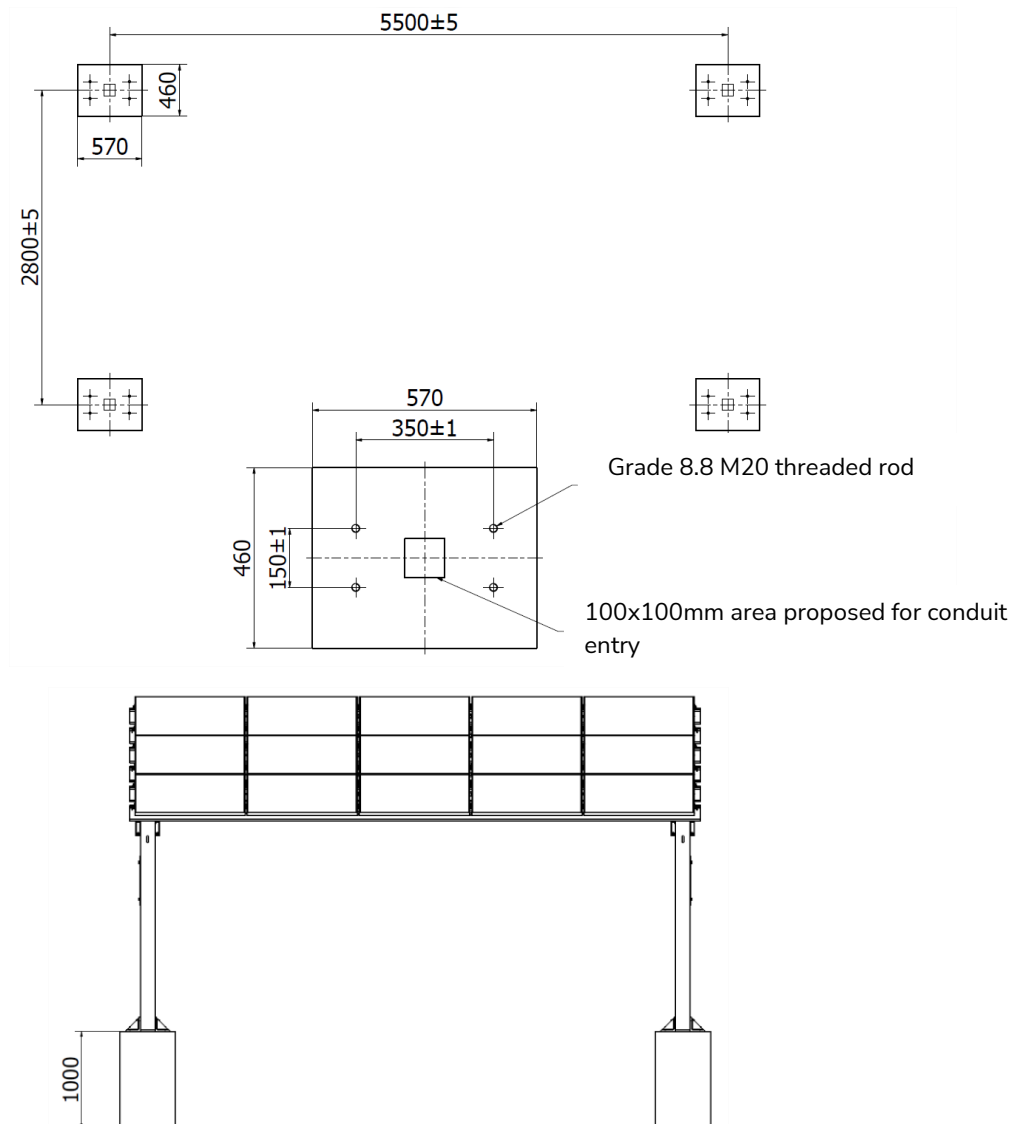


FIG. 1 Arrangement of the foundations

3. To ensure many years of failure-free and, above all, safe operation of the structure, the following rules must be followed:

-The structure should not be located in the immediate vicinity of objects higher than 3 [m] because this may result in too much snow load on the surface.

-Snow should be removed from the photovoltaic modules if the snow depth exceeds the values listed in table 1.

Table 1. Maximum snow cover thickness

Snow type	Volumetric weight	Maximum cover thickness
Fresh snow	1,0 [kN/m <sup>3</sup> ]	960 [mm]
Settled snow (a few hours/days after the rainfall)	2,0 [kN/m <sup>3</sup> ]	480 [mm]
Old snow (a few weeks after rainfall)	3,0 [kN/m <sup>3</sup> ]	320 [mm]
Wet snow	4,0 [kN/m <sup>3</sup> ]	240 [mm]
Icy snow	6,0 [kN/m <sup>3</sup> ]	160 [mm]
Ice	9,0 [kN/m <sup>3</sup> ]	107 [mm]

4. All channel bars must be measured and sorted as shown in Table 2.

Table 2. List of construction components

COMPONENT NO.	QUANTITY	COMPONENT NAME	DESCRIPTION
W-01-01	2	Support I	L=2400 [mm]; 150x45x18x3 [mm]
W-01-02	2	Support II	L=2490 [mm]; 150x45x18x3 [mm]
W-01-03	2	Support III	L=2805 [mm]; 150x45x18x3 [mm]
W-01-04	2	Support IV	L=3255 [mm]; 150x45x18x3 [mm]
W-01-05	4	Rafter	L=5935 [mm]; 150x45x18x3 [mm]
W-01-10	12	Beam	L=5935 [mm]; 150x45x18x3 [mm]

5. The baseplates (W-01-09) must be attached to the previously made foundations, and it is recommended that they be bolted together using M20 washers (DIN 9021) and grade 8.8 M20 self-locking nuts. (DIN 982/985). The nuts must be **pre-tightened** at this stage. The baseplates come in right- and left-hand versions, differing in the arrangement of the holes for the threaded rods.

**NOTE: Keno sp. z o.o. does not supply nuts and M20 washers.**

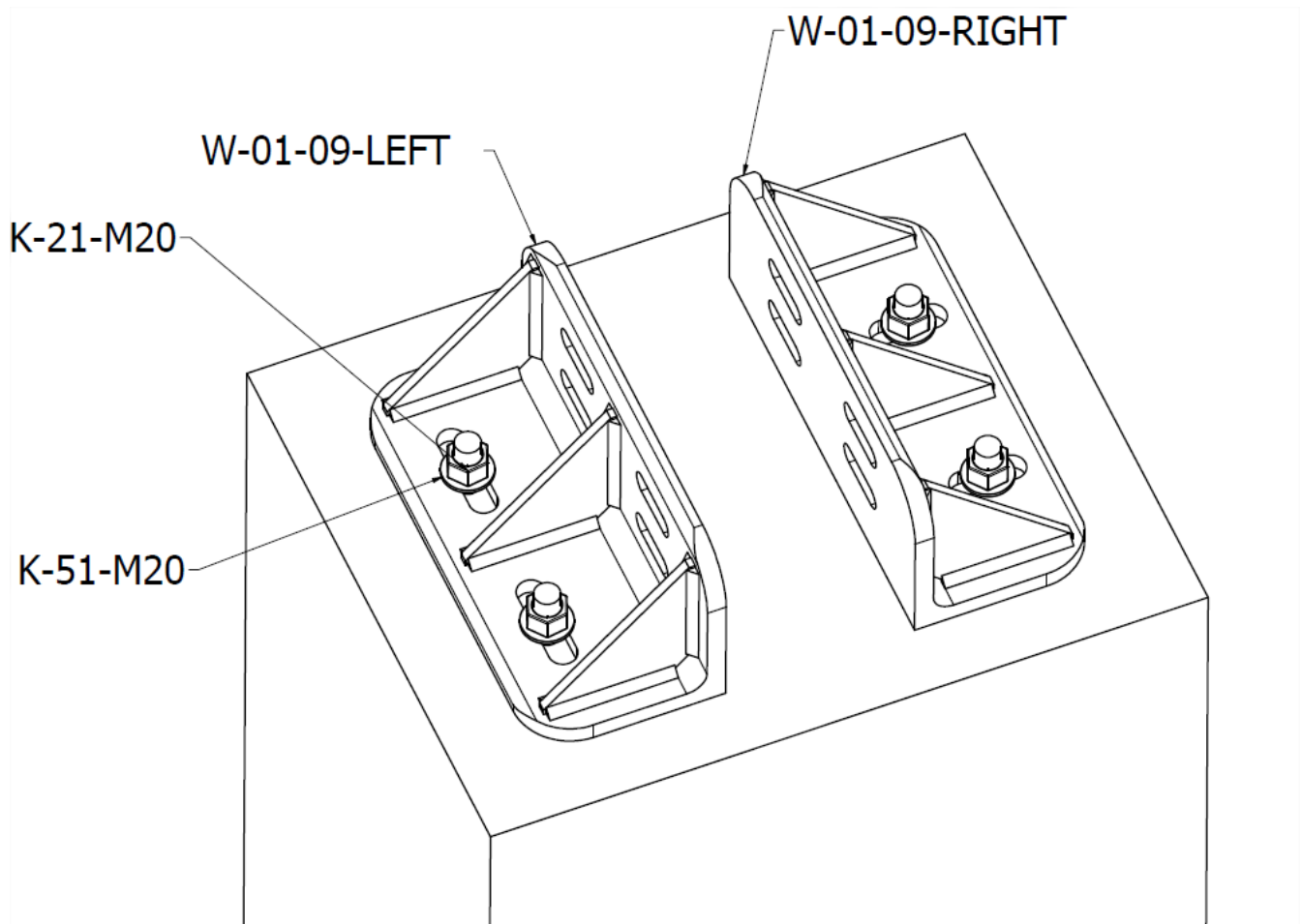


FIG.2 Pre-bolting the baseplates

6. The next step is to pre-bolt the rafter (W-01-05) to the four supports (W-01-01, W-01-02, W-01-03, W-01-04).

The following must be used for this:

- 4x K-28-M16-35 hexagon head bolt;
- 4x K-51-S-M16 spring washer;
- 4x K-51-P-M16 expanded washer;
- 4x K-51-M16 washer;
- 4x K-21-M16 hexagon nut.

The supports (W-01-01/02/03/04) must be fastened to the oblong holes in the rafter one by one. To do so, proceed as follows: starting from the rafter side, put a hexagon bolt (K-28-M16-35) with an expanded washer (K-51-P-M16) through the prepared oblong hole and through the circular hole in the support, then place a washer (K-51-M16) and a spring washer (K-51-S-M16) on the bolt on the support side and secure the connection using a hexagon nut (K-21-M16). Reference (FIG.3, FIG.4) for what the final result should look like. The supports must face with the open "U" side inwards.

**NOTE:** Before pre-tightening, measure the distance from the beginning of the rafter to the nearest edge of the first opening. From the side where this dimension is 411 [mm], the supports must be bolted in the following order: W-01-01, W-01-02, W-01-03, W-01-04 (FIG.4).

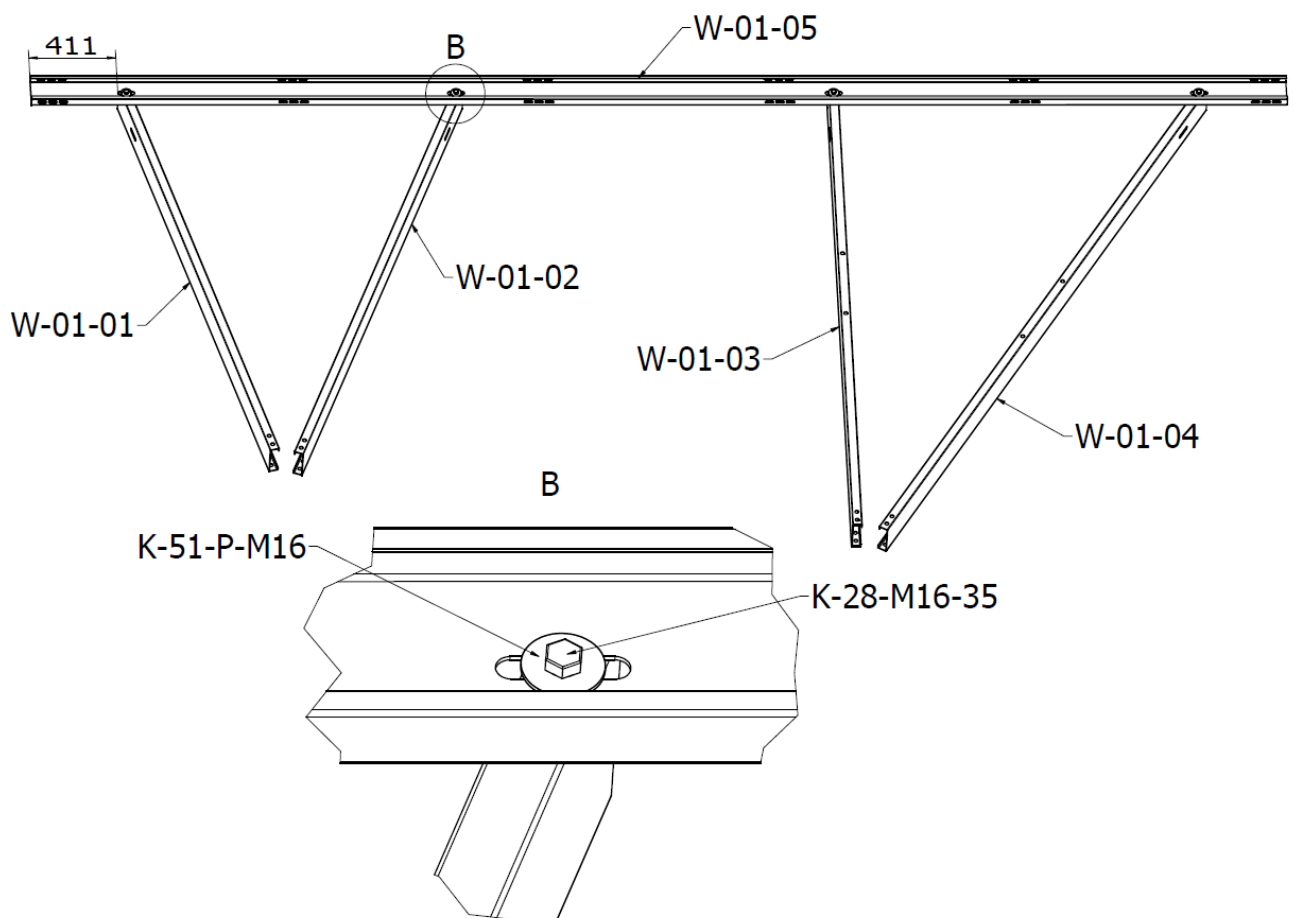


FIG.3 Pre-bolting the rafter to the supports (1st projection)

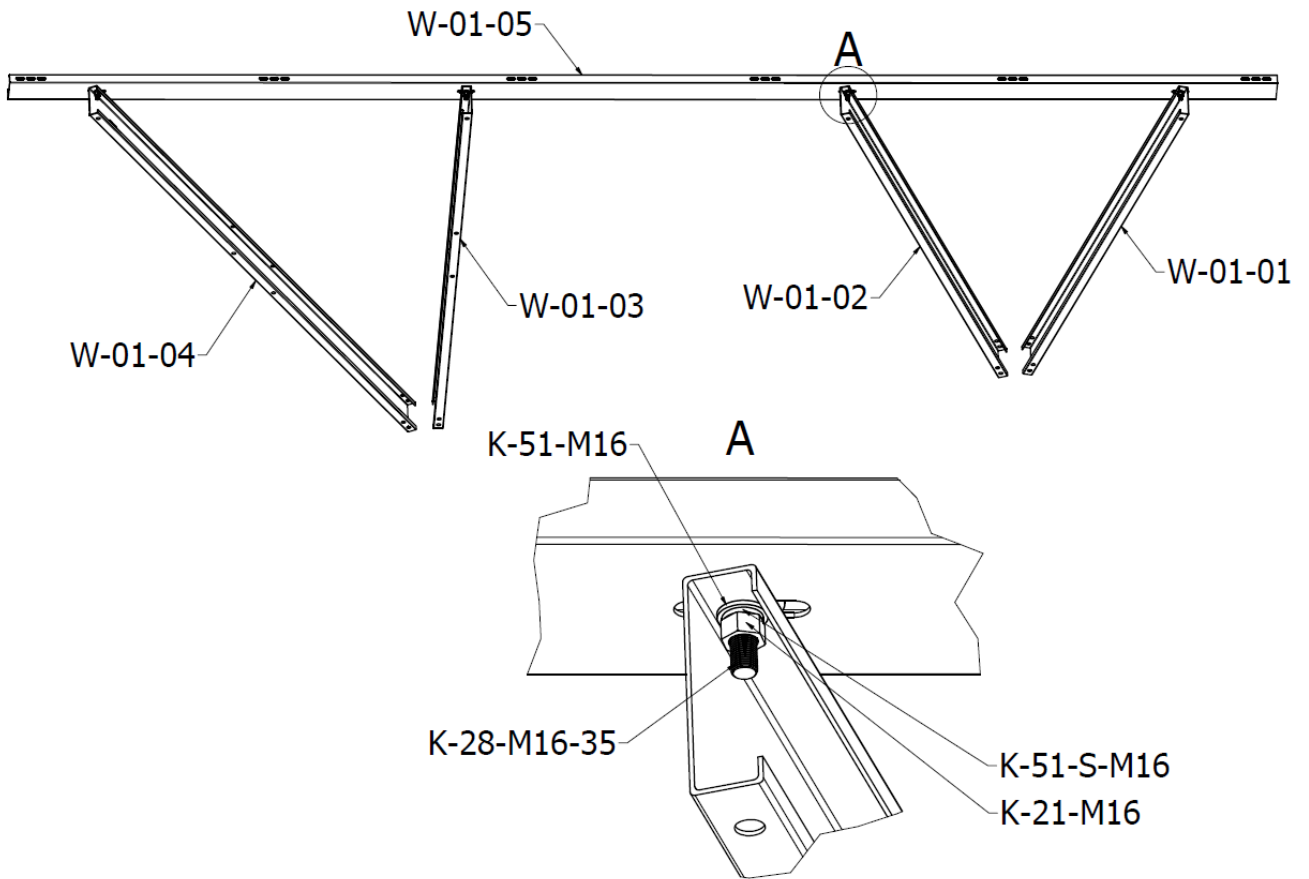


FIG.4 Pre-bolting the rafter to the supports (2nd projection)

7. The next step is to pre-bolt the second rafter on the opposite side of the support.

A proper bolting requires the following:

- 4x K-28-M16-35 hexagon head bolt;
- 4x K-51-S-M16 spring washer;
- 4x K-51-P-M16 expanded washer;
- 4x K-51-M16 washer;
- 4x K-21-M16 hexagon nut.

To pre-bolt the second rafter, proceed as described in item five (bolting the first rafter).

**NOTE:** When installing the second rafter, measure the distance from the beginning of the rafter to the nearest edge of the first opening, which must be 411 [mm] on the side of support W-01-01.

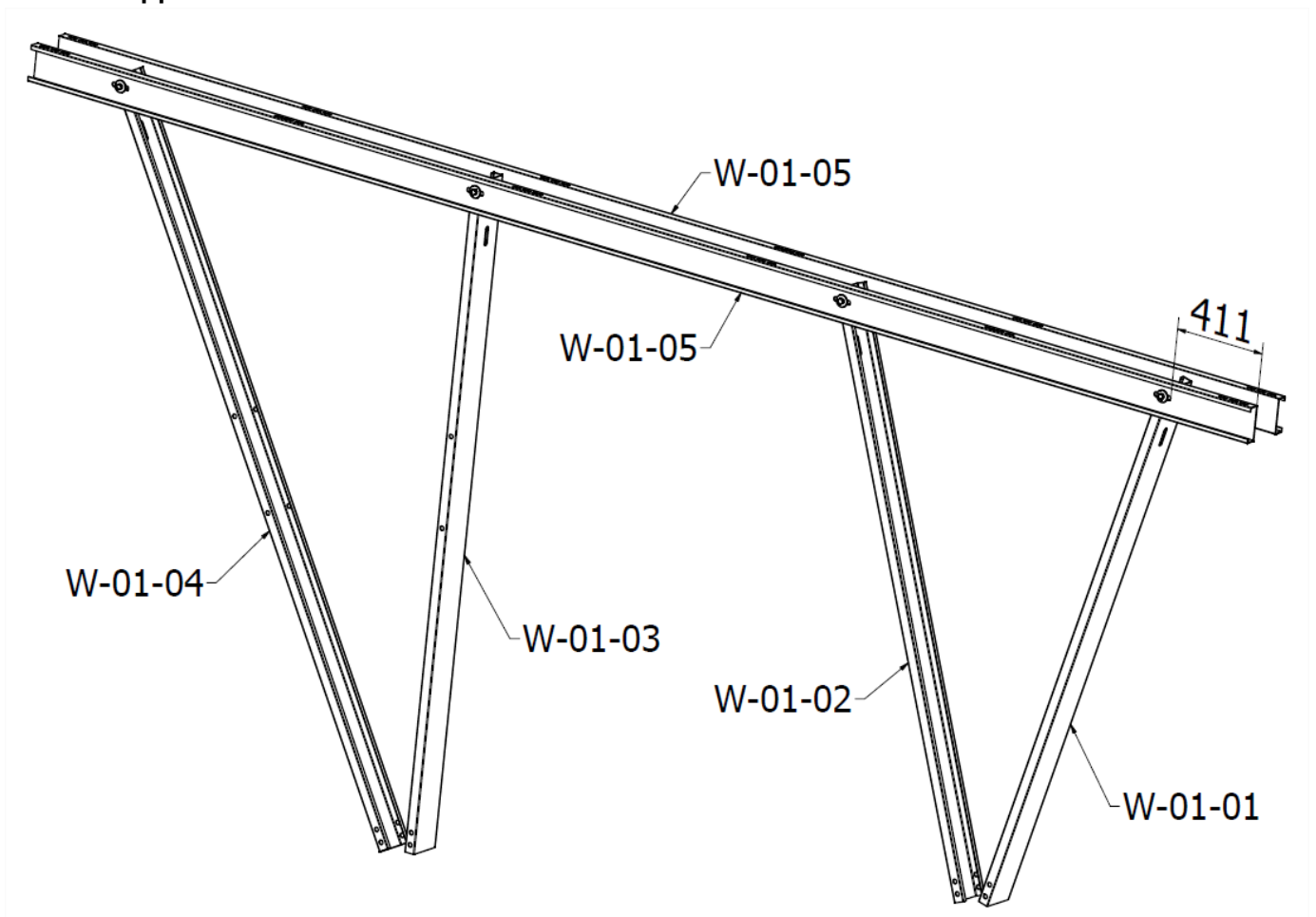


FIG.5 Pre-bolting the second rafter

8. The bolted structure must then be raised and the supports pre-bolted to the baseplates (*W-01-09-RIGHT*, *W-01-09-LEFT*).

This requires the following:

- 16x K-28-M16-45 hexagon head bolt;
- 16x K-51-S-M16 spring washer;
- 16x K-51-P-M16 expanded washer;
- 16x K-51-M16 washer;
- 16x K-21-M16 hexagon nut.

To properly bolt the support to the baseplates, insert the hexagon bolt (*K-28-M16-45*) with its washer (*K-51-M16*) through the hole in the baseplate, from the support side. The bolt positioned in this way must first be fitted with an expanded washer (*K-51-P-M16*), then with a spring washer (*K-51-S-M16*), and finally screwed together with a nut (*K-21-M16*) — reference (FIG.6, FIG.7). **Bolt the supports to the baseplates in the following order: W-01-04, W-01-03, W-01-02, W-01-01.**

**NOTE:** Make sure to use all holes prepared in the baseplates.

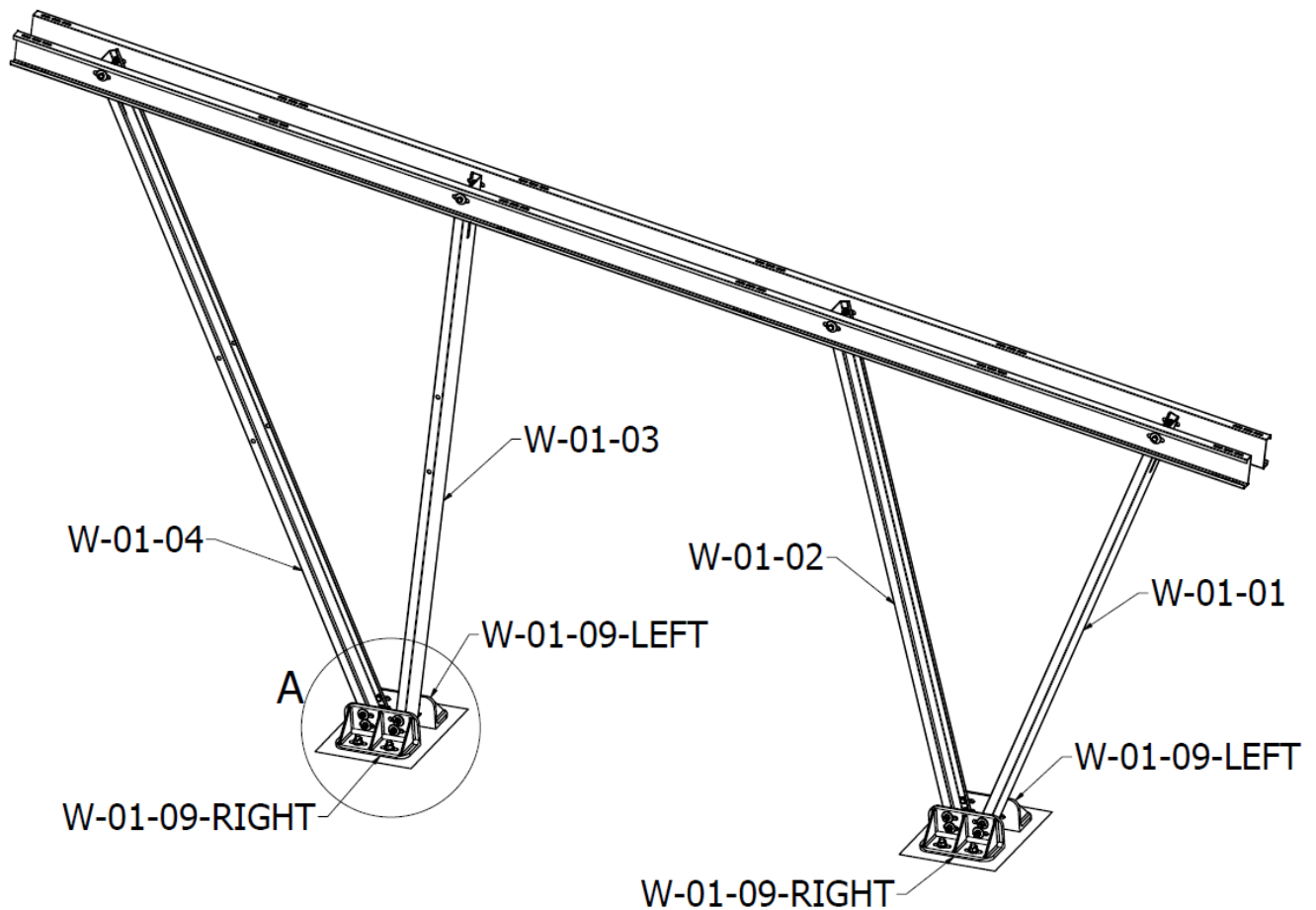


FIG.6 Bolting of supports to baseplates (detail A in FIG.7)

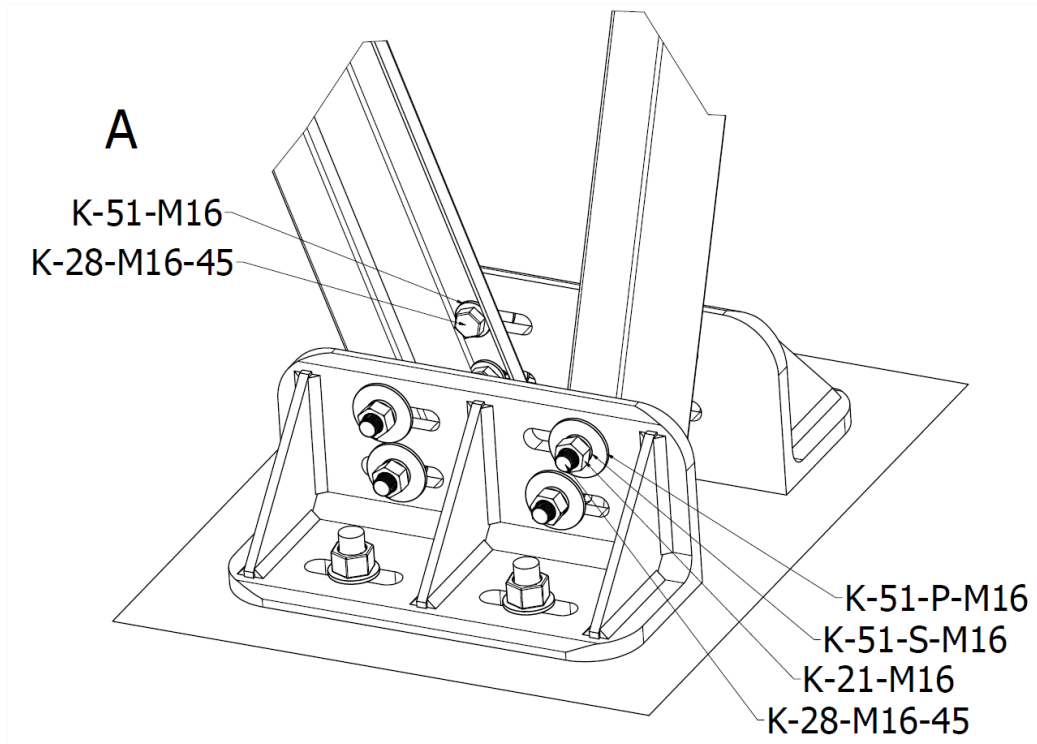


FIG.7 Bolting of supports to baseplates (detail A)

9. Bolt the second part of the supports and rafters together as per items 4–6 of these Assembly Instructions.

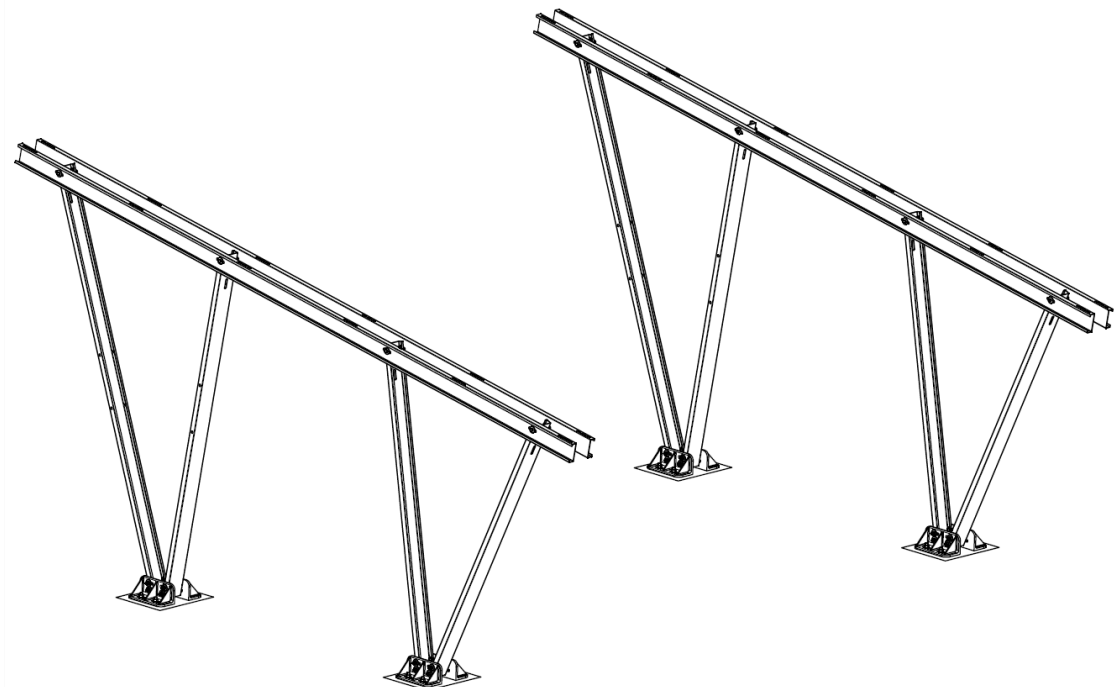


FIG.8 Assembly of the remaining supports

Once done, tighten all M20 nuts to a torque of 200 [Nm] and M16 nuts to a torque of 150 [Nm].

10. Then proceed to bolt the beams (W-01-10) together.

To do this, use the following to assemble each beam:

- 6x K-28-M16-35 hexagon head bolt;
- 6x K-51-S-M16 spring washer;
- 12x K-51-P-M16 expanded washer;
- 6x K-21-M16 hexagon nut.

To bolt the beam properly, position the two channel bars (W-01-10) back-to-back and then put the hexagon headed bolts (K-28-M16-35) together with the expanded washers (K-51-P-M16) through the six holes prepared in the channel bars. The bolts inserted in this manner must be fitted with washers (K-51-P-M16) and spring washers (K-51-S-M16), in this order, and then secured using hexagon nuts (K-21-M16).

**NOTE: Bolt all other beams in the same way.**

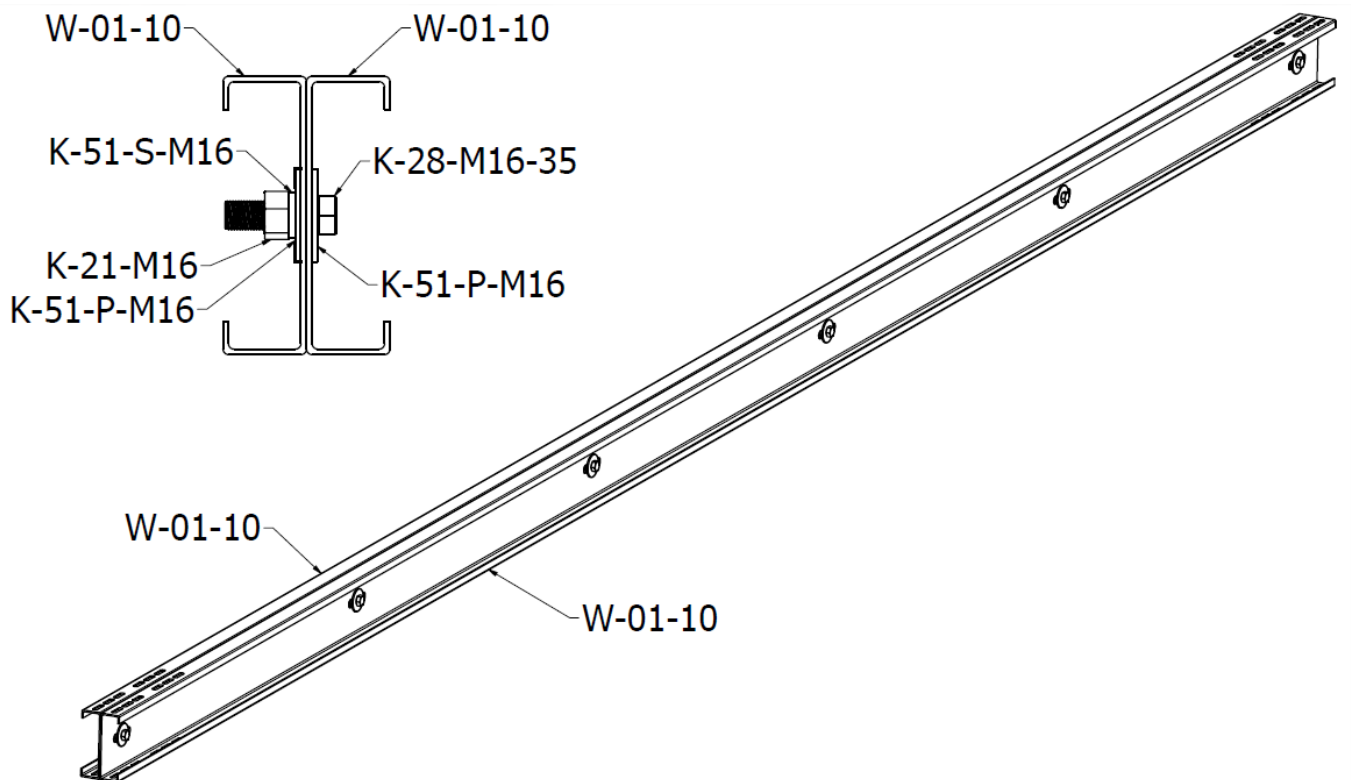


FIG.9 Joining W-01-10 channel bars together

**Tighten the M16 bolts to a torque of 150 [Nm].**

11. The next step is to assemble the previously bolted beams with the rafters (W-01-05).

Use the following to bolt each beam to the rafters:

- 8x K-28-30 hexagon head bolt
- 8x K-21 hexagon nut
- 8x K-51 washer

Proper assembly requires putting the hexagon head bolts (K-28-30) together with the washers (K-51) through the prepared holes in the beams, and then securing them from the rafter side using the hexagon nuts (K-21) — reference (FIG.10, FIG.11).

**NOTE: When assembling the beams, use the appropriate holes in the rafters so that the spacing between the beams corresponds to the module assembly zone.**

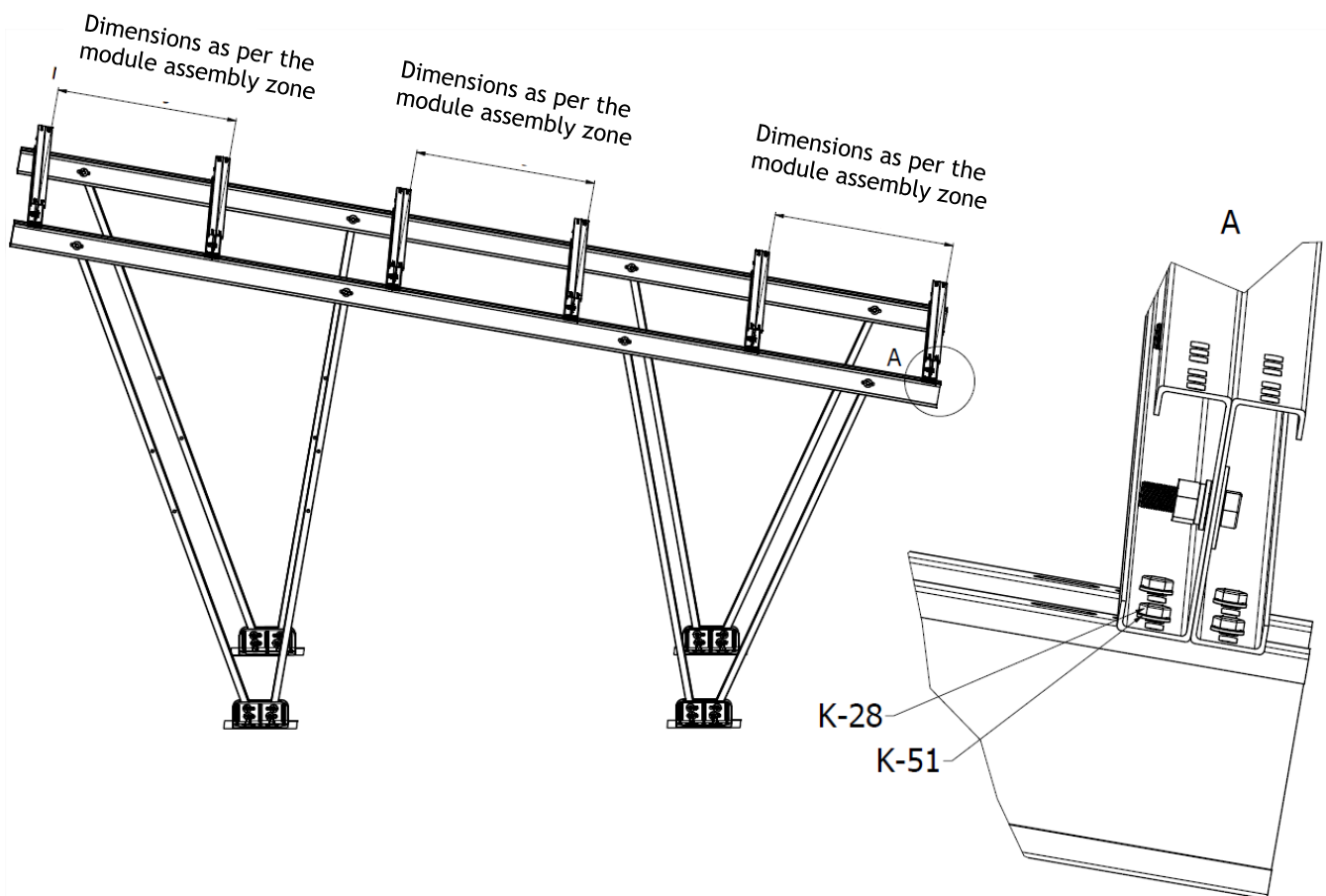


FIG.10 Assembling the beams on the rafters (1st projection)

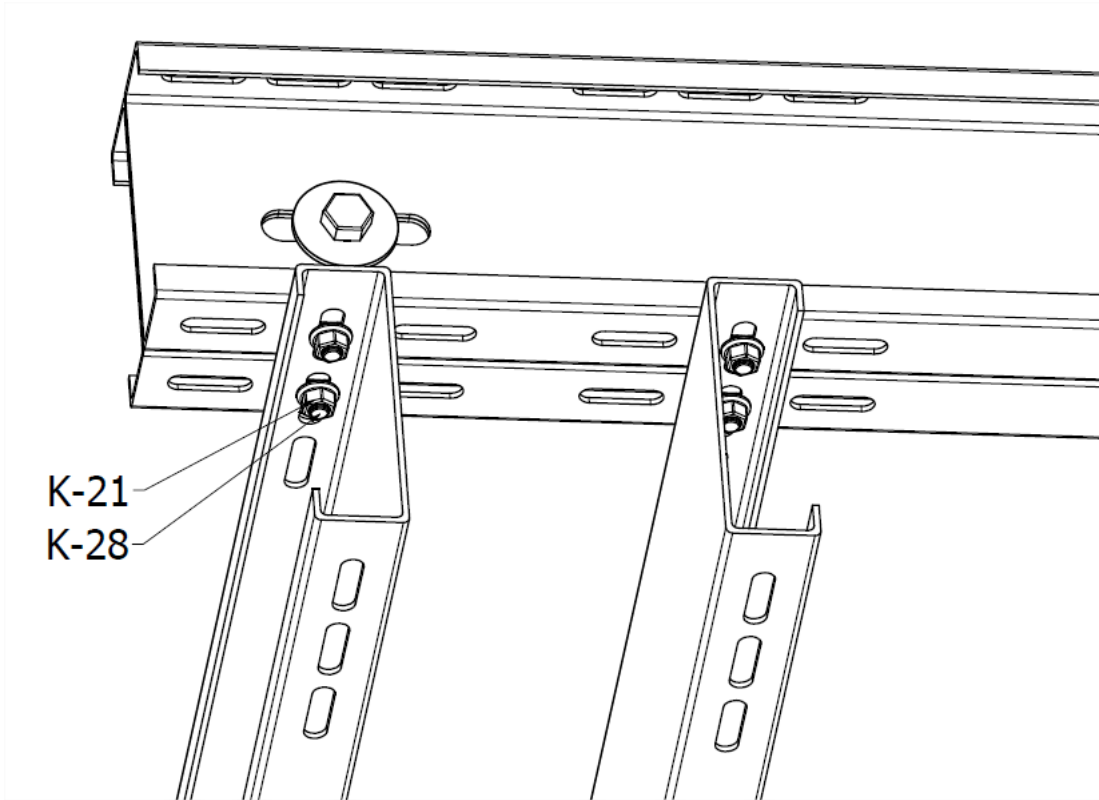


FIG.11 Assembling the beams on the rafters (2nd projection)

**Tighten the K-28-30 M10 bolts to a torque of 30 [Nm].**

12. In the next step, proceed to assemble the photovoltaic modules using the brackets (W-01-12), the middle clamps (K-05), the end clamps (K-06) and the Allen screws (K-18-35) — reference (FIG.12).

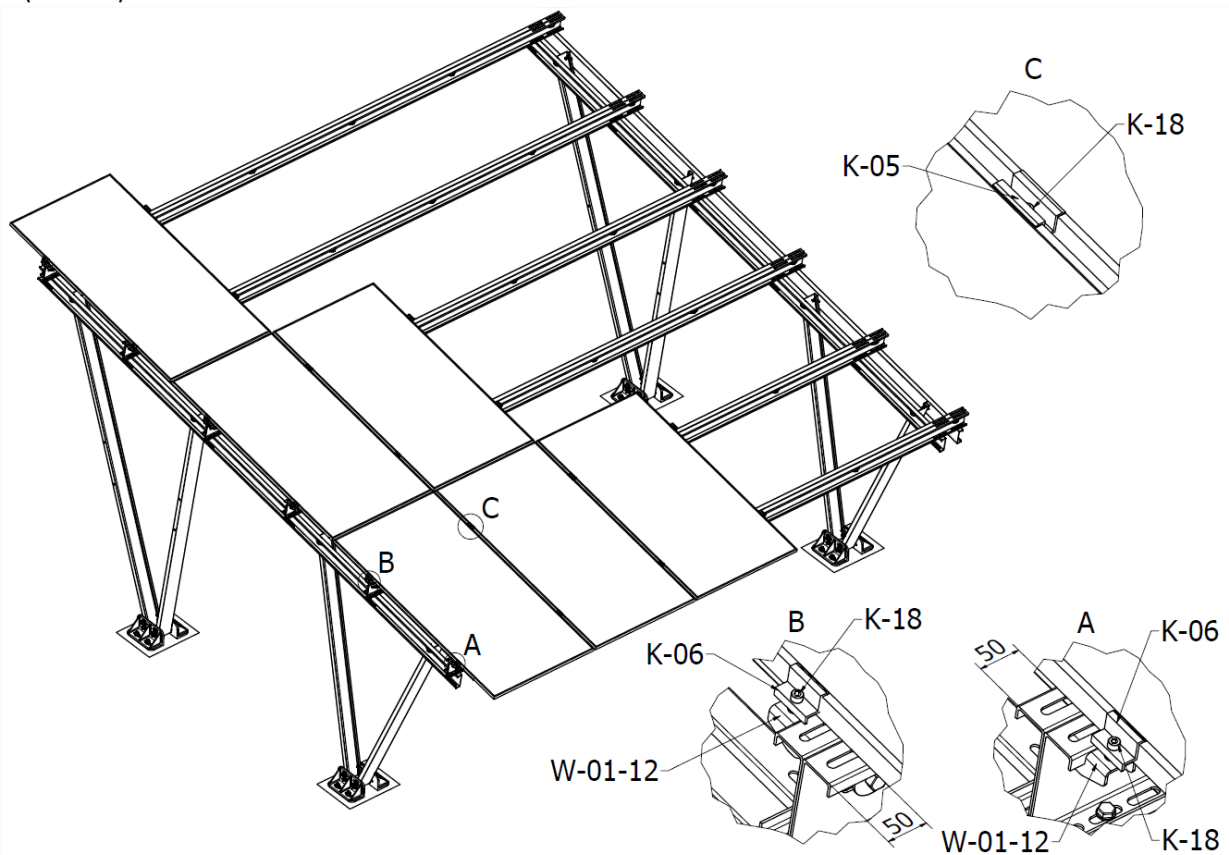


FIG.12 Assembling photovoltaic modules

- A — Assembling the end clamps
- B — Assembling the end clamps
- C — Assembling the middle clamps

**NOTE:** As shown in (FIG.12), the bracket can be mounted on either the bottom or the top channel bar, depending on the assembly zone requirements of the module.

**All K-18 Allen screws must be tightened to a torque of 18 [Nm].**

13. The modules must be fitted row by row, starting from the bottom row and following the pre-tightening of the bottom row of end clamps. To mount the modules at equal distances in a row (FIG.13), the middle clamps may be used as spacers but must be removed after assembly.

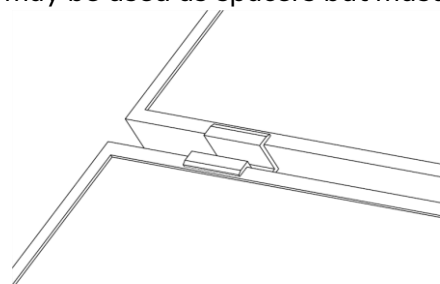


FIG.13 Using middle clamps as spacers

14. Optionally, a charger/inverter bracket may also be mounted. To do so, insert hexagon head screws (K-28-M16-35) with washers (K-51-M16) through the holes in the sheet metal bracket and secure them from the other side using a washer (K-51-M16), a spring washer (K-51-S-M16) and a hexagon nut (K-21-M16) tightened to a torque of 150 [Nm].

Use the following to assemble each sheet metal bracket:

- 4x K-28-M16-35 hexagon head bolt;
- 4x K-51-S-M16 spring washer;
- 8x K-51-P-M16 washer;
- 4x K-21-M16 hexagon nut.

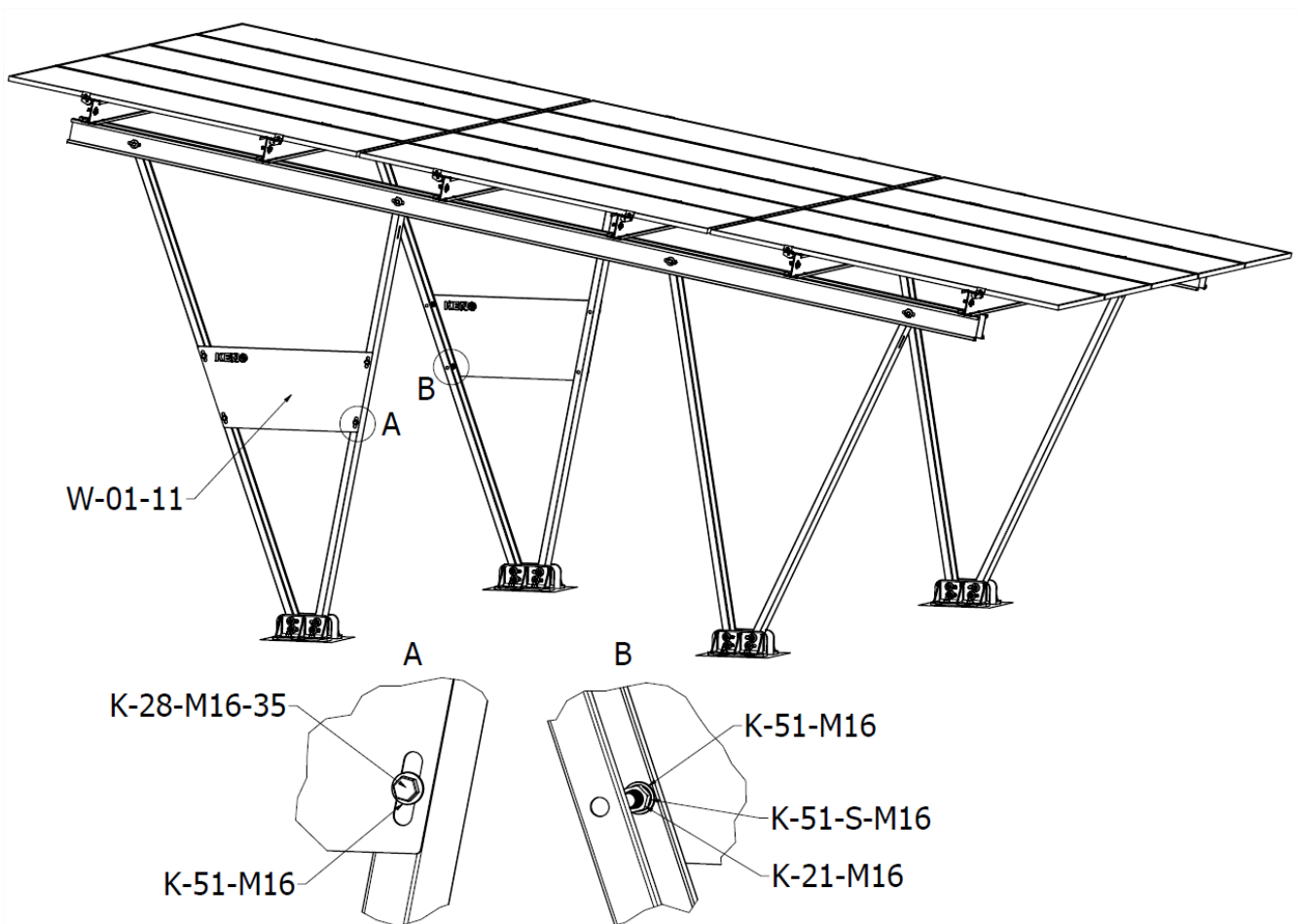


FIG. 14 Assembling the charger/inverter bracket

To mount an inverter, drill holes in the W-01-11 bracket corresponding to the spacing required for the device. Drill at slow speed, without overheating the material, using 2.3 intermediate drills. Secure the finished holes with zinc paint.

15. Overview of the assembled structure

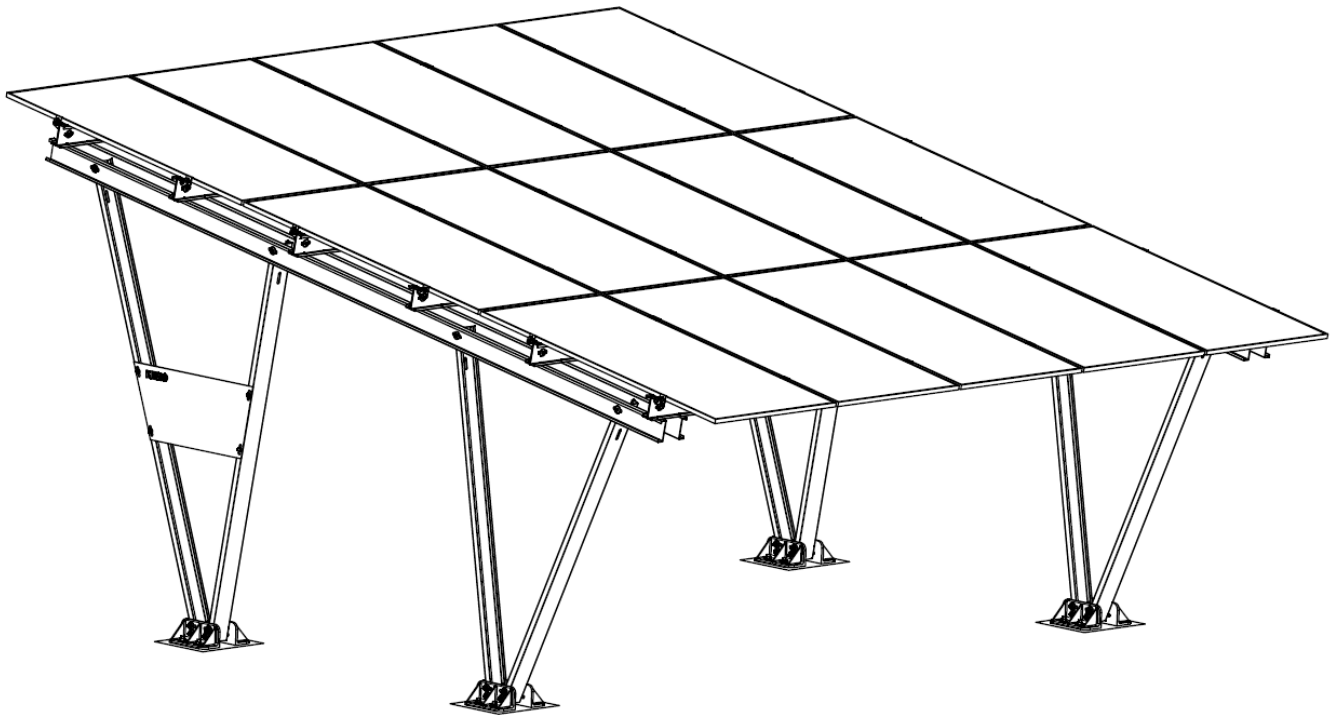


FIG. 15 Assembled structure

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