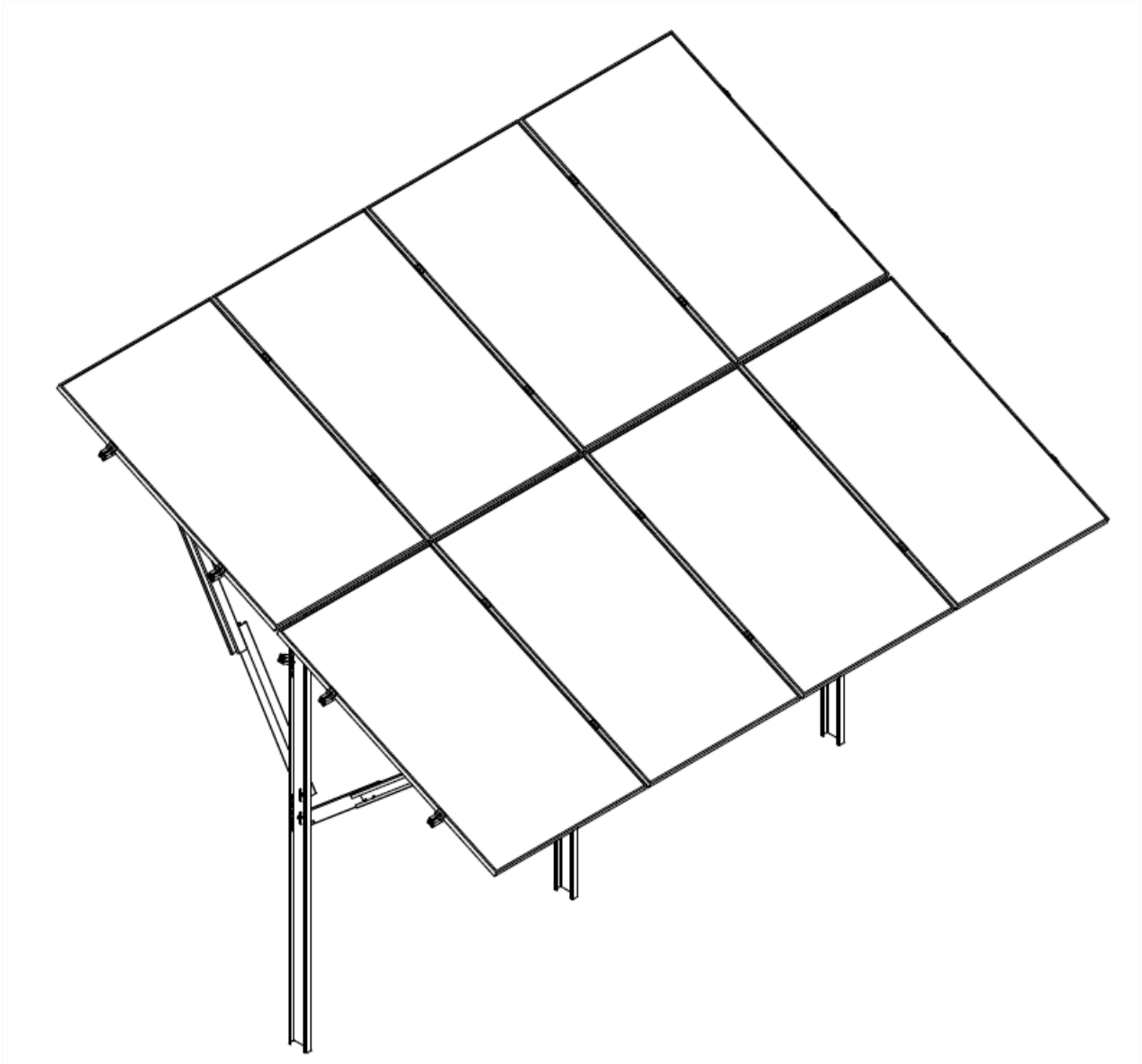
# ASSEMBLYINSTRUCTIONS FOR
## THE GROUND STRUCTURE
## SINGLE-SUPPORTED
## TWO MODULES VERTICALLY



**The mounting system described below is used to fix photovoltaic modules in vertical orientation with an angle of inclination of 25 degrees. The design is compatible with modules from 1800 mm to 2384 mm in height.**

During production, every effort was made to ensure that you receive a top-quality product that is also easy to install. This manual is a set of rules for the correct installation of the assembly components, but is not a blueprint or a substitute for it. The installer carrying out the installation must be suitably trained and qualified for the job. Overall responsibility for correct installation rests with the installer, who should choose the right type of construction.

1. **In order to assemble the structure by hammering, it is necessary to have suitable machinery, e.g. a pile driver or an excavator with a suitable adapter with a load-bearing section – Fig. 1.**

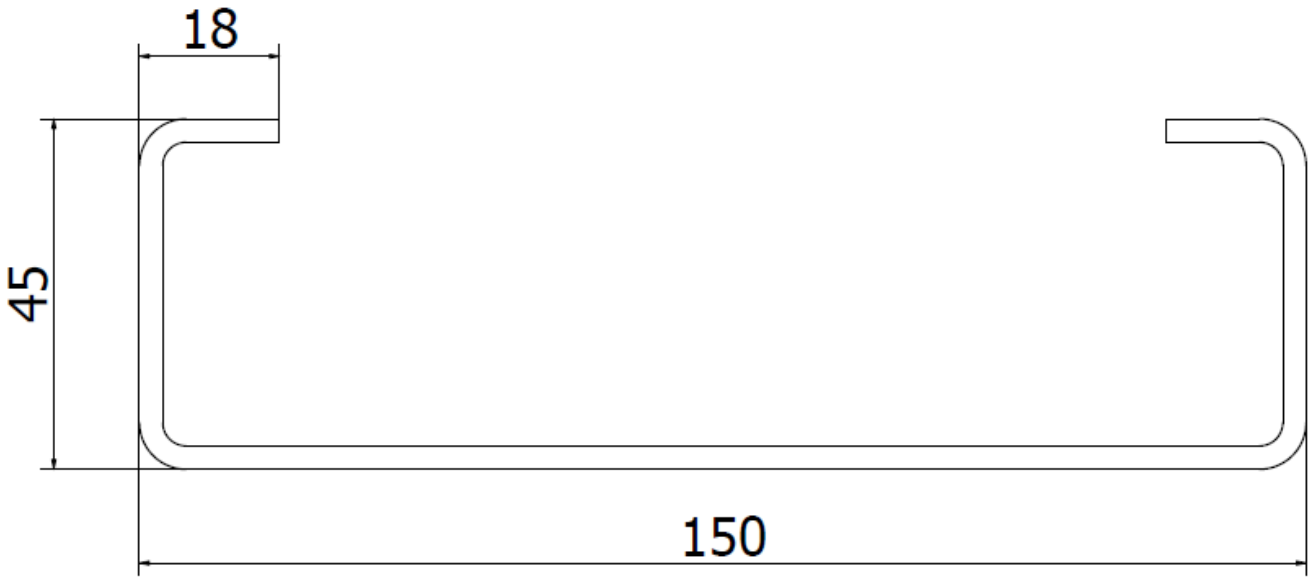



*FIG1. Cross-section of a support driven into the ground*

2. Arrange the layout of the modules in such a way as to minimise or exclude the appearance of shadow on the modules, especially so that, in the case of a larger number of tables, the preceding row does not cast a shadow on the next row – calculate the required distances between rows and bear in mind that even the shadow cast by trees or buildings can limit the yields generated by the modules. When installing the system in summer, it is important to be aware that the shadow cast by trees, neighbouring buildings and the following rows will reach much further in winter.

3. The length of one table can be calculated according to the formula; remember that the maximum length of a single table is **20 m**:

**ARRAY LENGTH = NUMBER OF MODULES * (MODULE HEIGHT + 20mm) + 60mm**

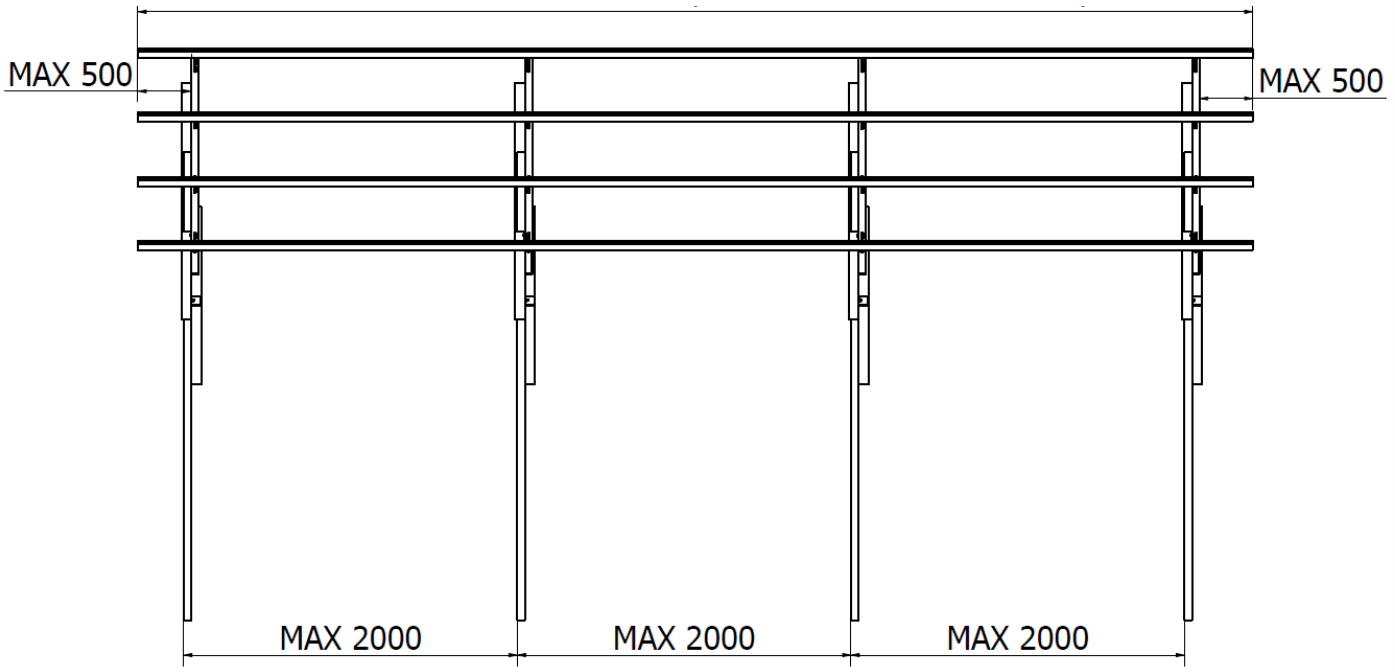



*FIG.2. Table length*

4. The erection of the structure shall be started by marking out points on the ground at which the main supports will be hammered in. One table consists of one row of supports. The spacing between them can be a **maximum of 2 000 mm**.

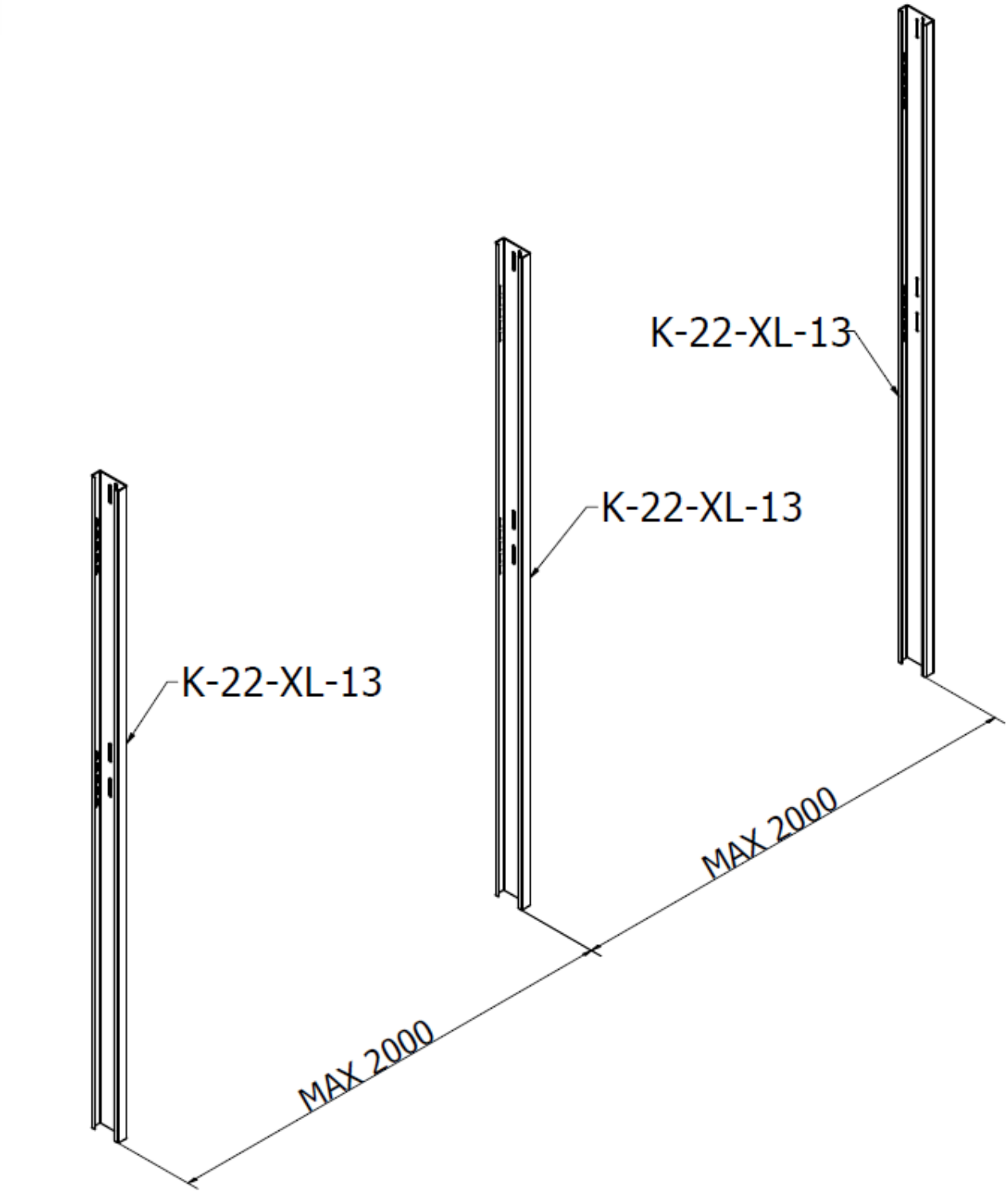



*FIG.3.* Support *spacing*

5. Supports must be driven to a **MIN depth of 1500 mm**. When driving in the supports, use a spacer, preferably in the form of a dedicated adapter suitable for its cross-section – Fig.1, direct contact with the component being driven is prohibited. This will prevent mechanical damage and the removal of the anti-corrosion coating from the supports. While driving in, check their vertical position.

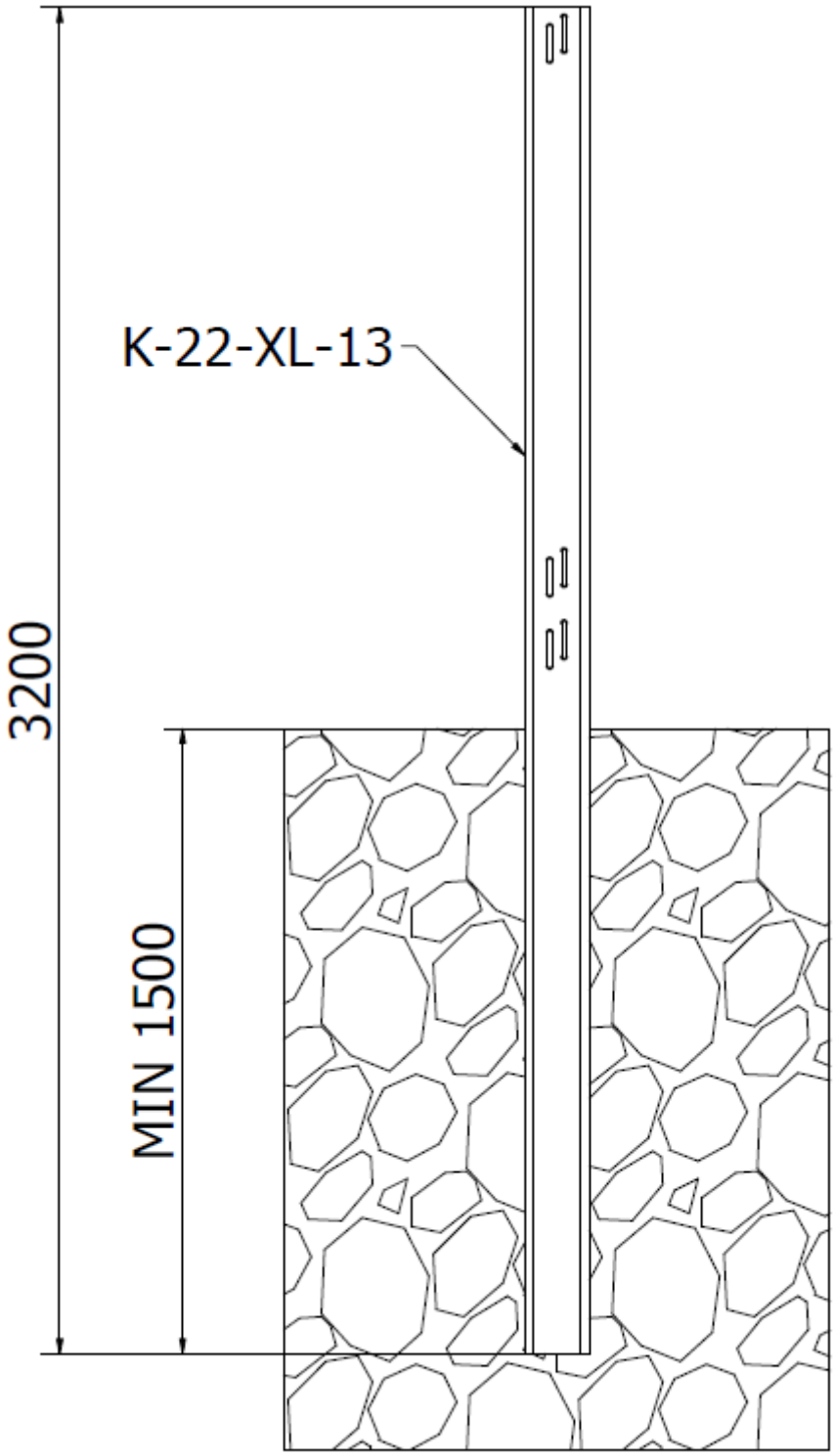



FIG.4. *Installation of supports in the ground*

6. Once all the supports have been stably and correctly installed to the ground, you can proceed to install the K-22-XL-15 rafters to the individual supports. Insert the K-69 Allen bolts, together with the K-51 washers, into the holes of the K-22-XL-15 rafters, and then pre-tighten on the opposite side with the K-22-XL-13 support using the K-21 nuts.

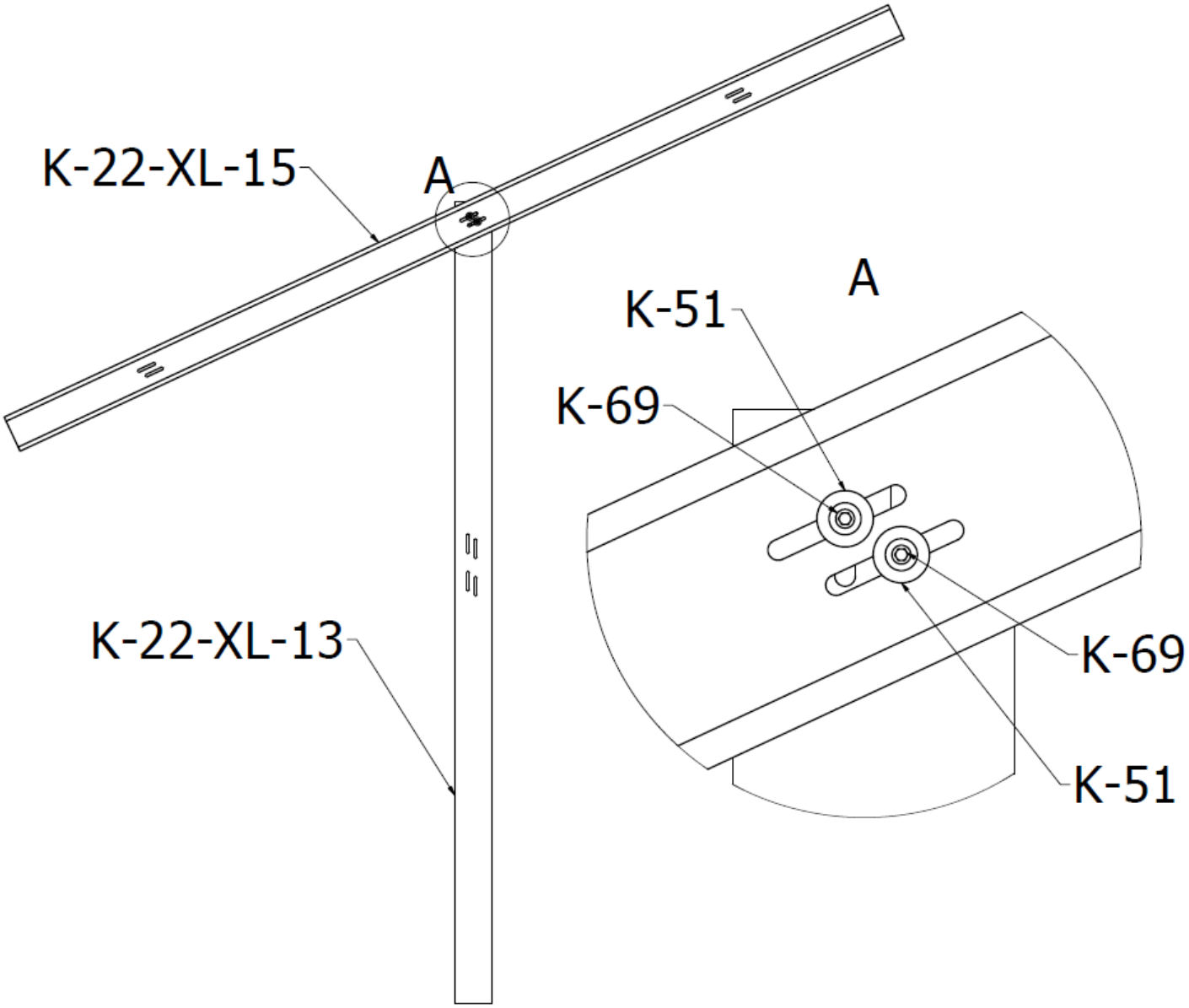



*FIG.5. Assembly of rafters with support (projection I)*

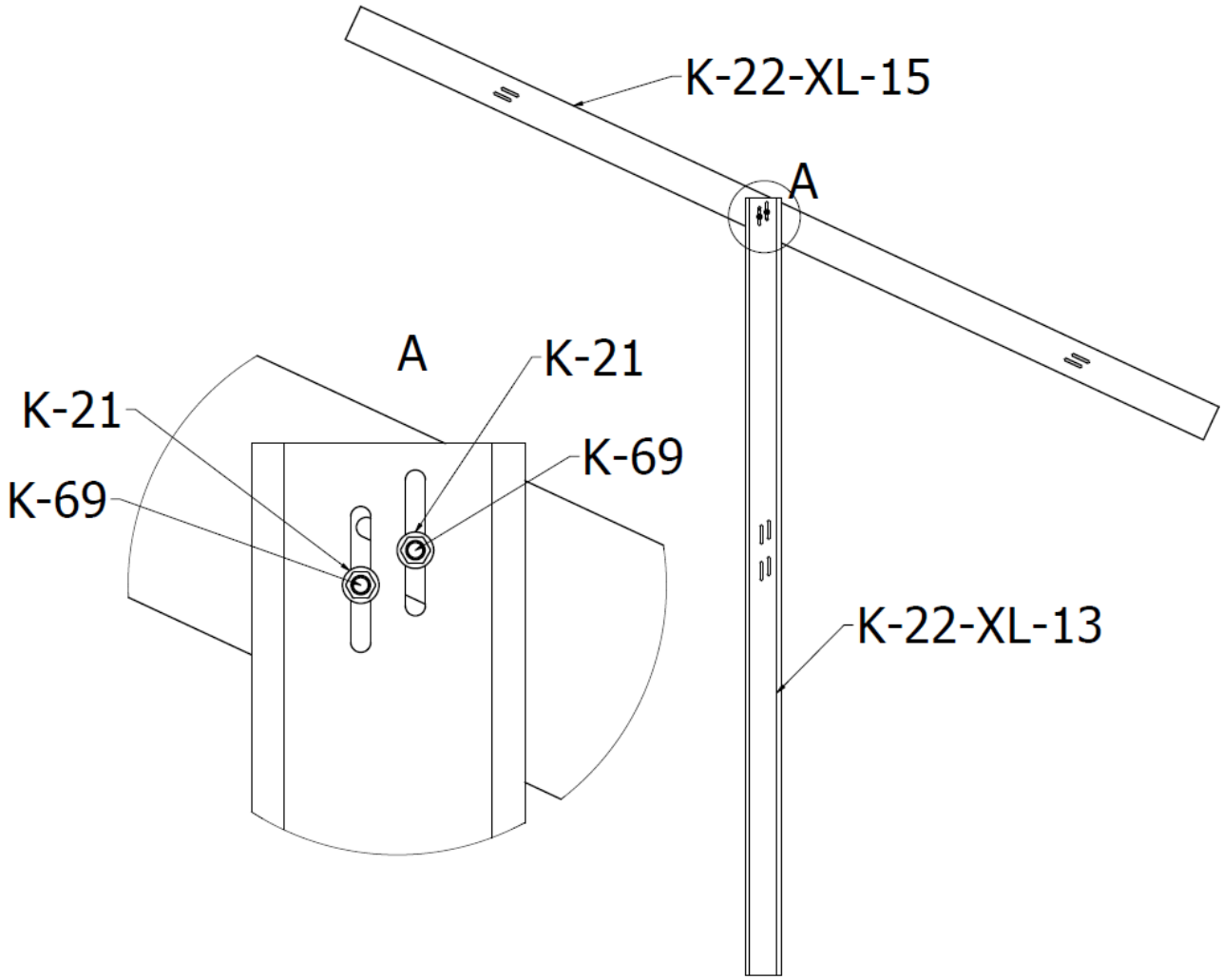



*FIG. 6. Assembly of rafters with support (projection ll)*

7. Once the rafters have been correctly assembled to the support, proceed to screw together, using the prepared holes, the two parts of the long arms K-22-XL-19 and the two parts of the short arms K-22-XL-18 – Fig.7. **To screw together two identical arm sections, use two K-28 hex head screws, two K-51 washers, and two K-21 nuts.**

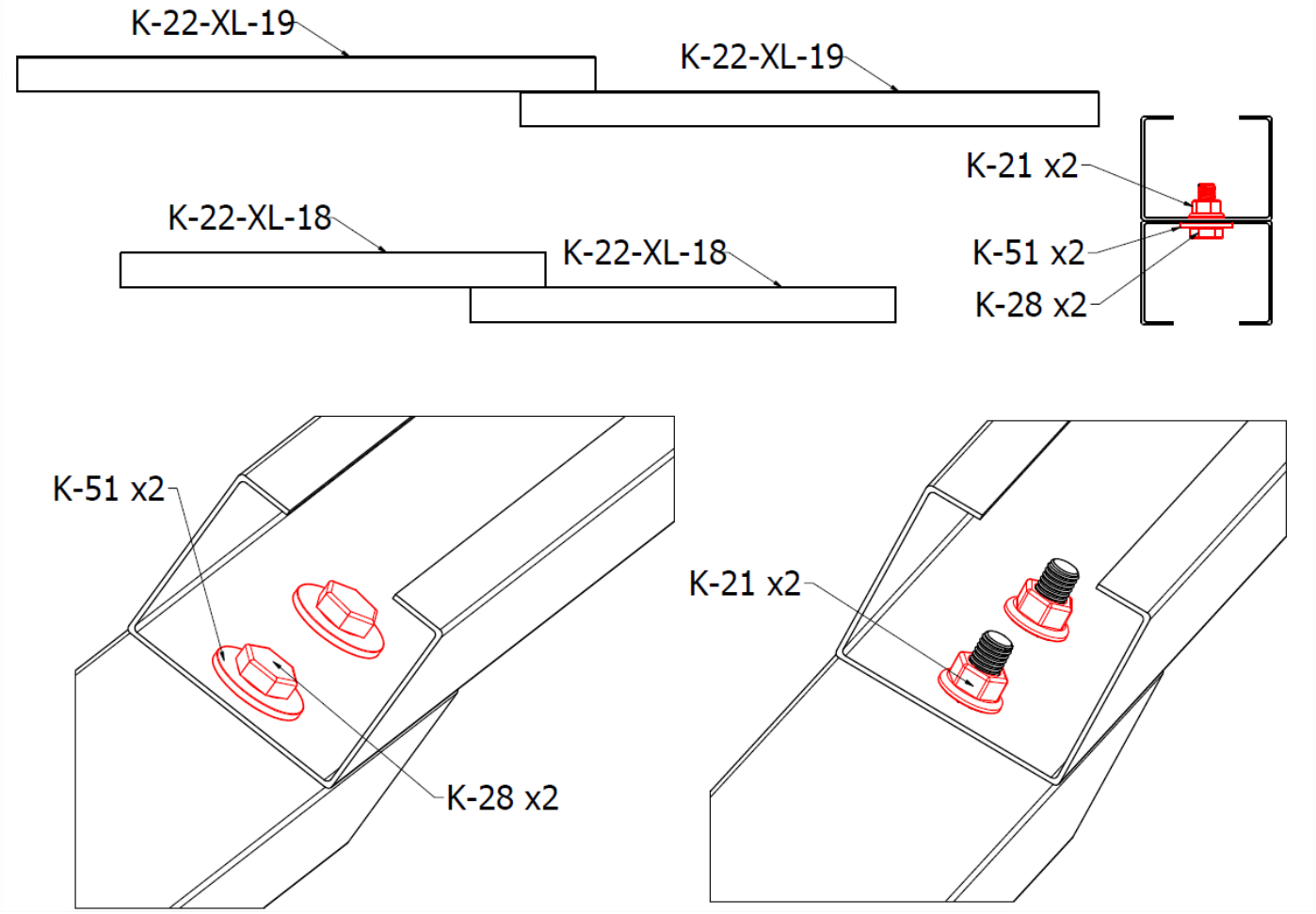



*FIG. 7. Arm twisting*

8. In the next step, the two parts of the K-22-XL-19 long arm, which were previously bolted together, should be screwed to the K-22-XL-15 rafter and the K-22-XL-13 support. For correct assembly, use two K-28 hexagonal head screws, two K-51 washers, and two K-21 nuts. The hexagonal head screws and washers should be inserted from the arm side, then tightened using a nut from the opposite side
**NOTE: The long frame should always be fitted to the uppermost hole in the support and the upper hole in the rafter.**

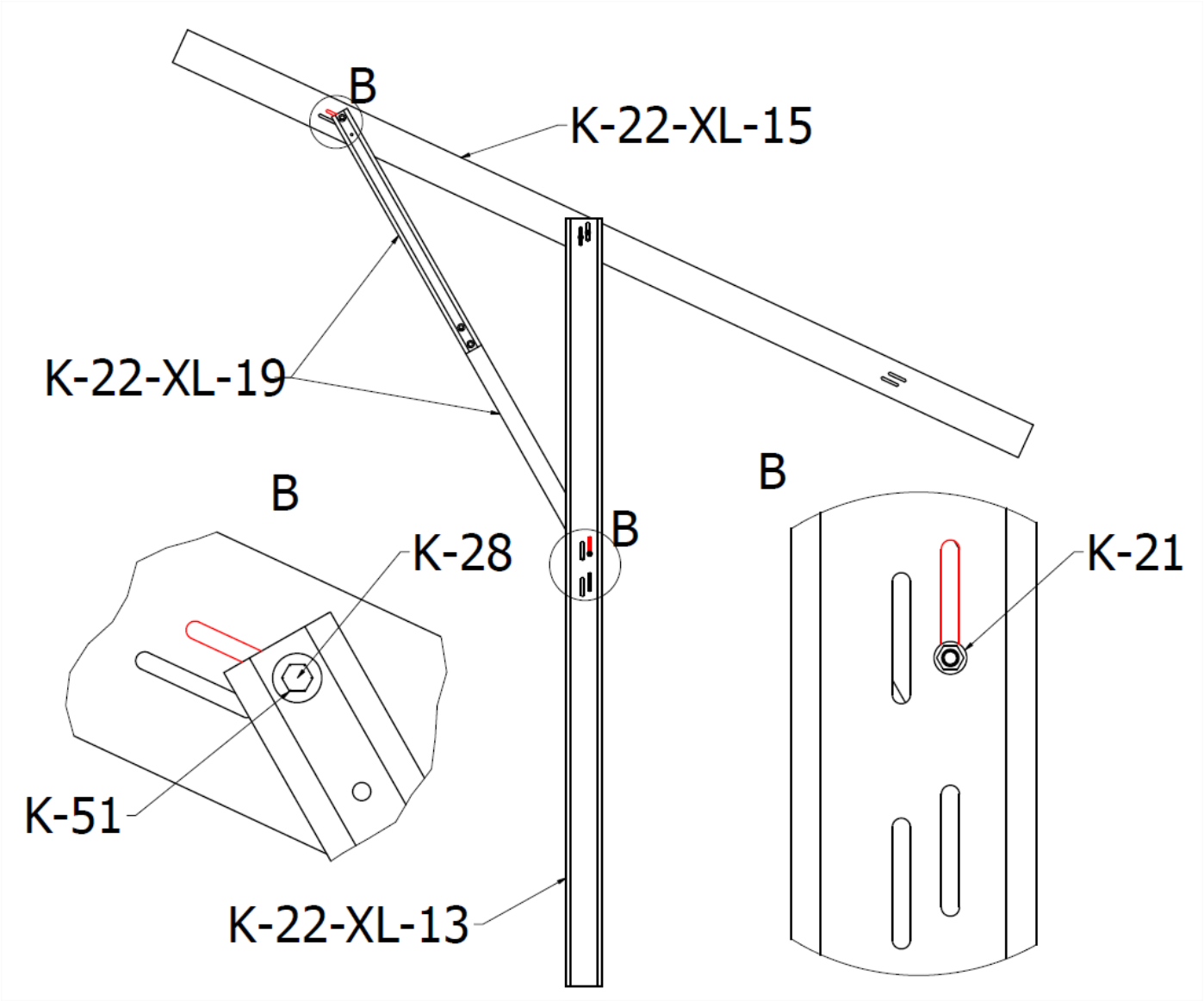



*FIG. 8. Assembly of* the longer arm to the main beam and support (projection I)

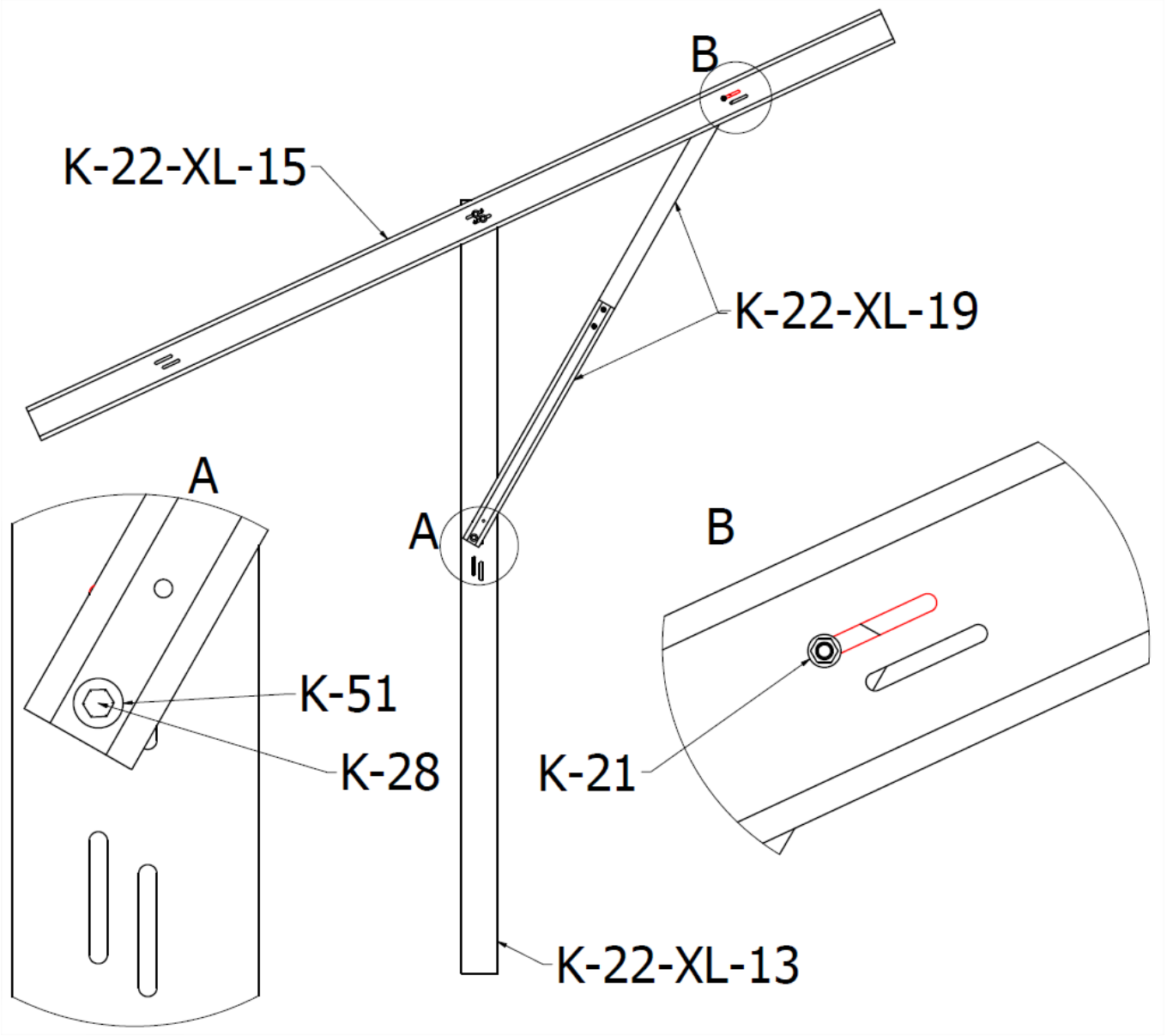



*FIG. 9. Assembly of* the longer arm to the main beam and support (projection II)

**9.** In the next stage, the two parts of the shorter K-22-XL-18 arm should be screwed together to the K-22-XL-15 rafters and the K-22-XL-13 support. For correct assembly, use two K-28 hexagonal head screws, two K-51 washers, and two K-21 nuts. The hexagonal head screws and washers should be inserted from the arm side, then tightened using a nut from the opposite side.
**NOTE: The shorter arm should always be mounted to the lowest hole in the support and the upper hole in the rafter.**

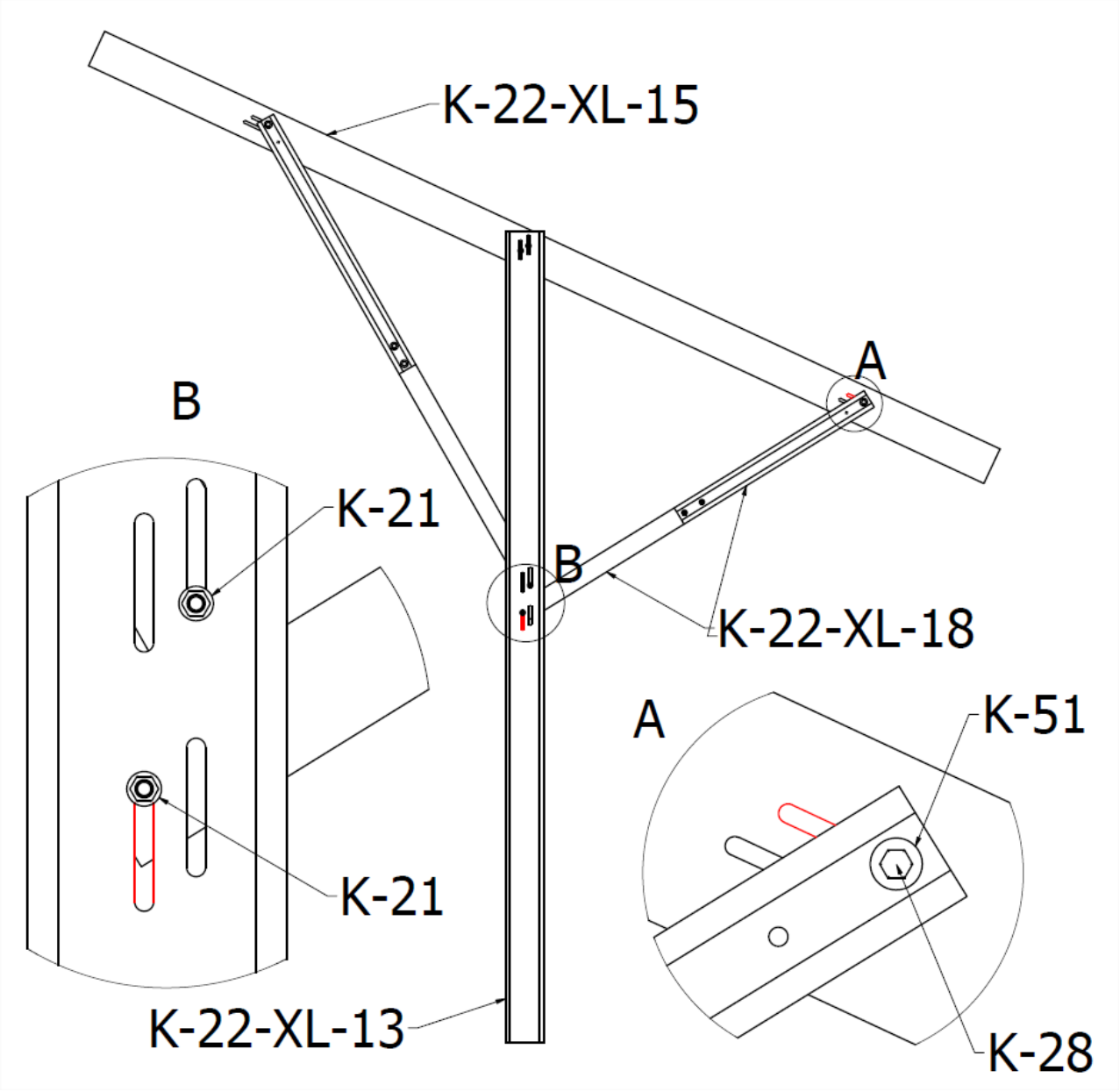



*FIG. 10. Assemble* the shorter arm to the main beam and support (projection I)

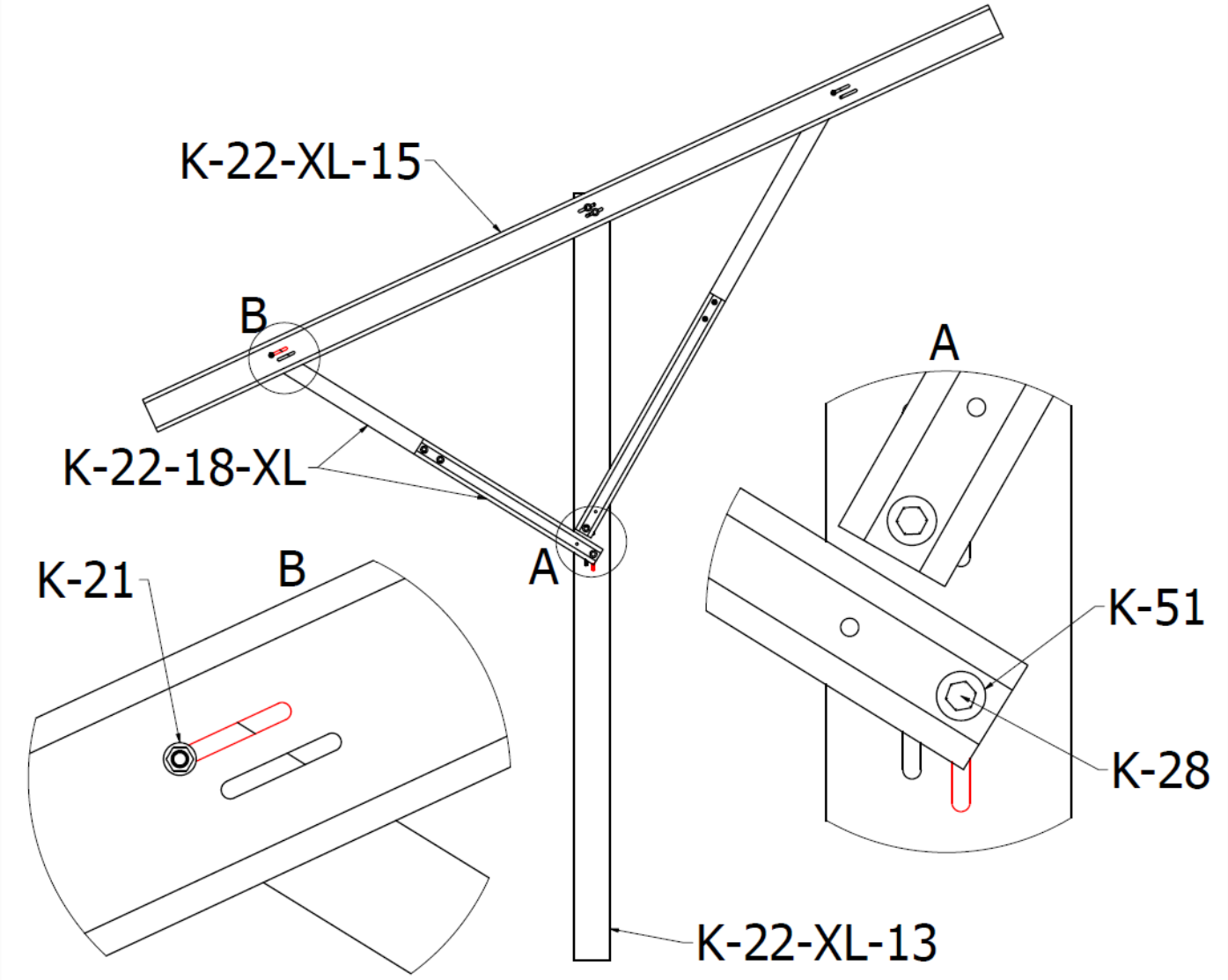



*FIG. 11. Assemble* the shorter arm to the main beam and support (projection II)

**10.The structure thus prepared should be tightened to a torque of 30 Nm.**

**11.** Prepare the aluminium mounting profiles. Connect them in an amount corresponding to the length of the entire structure. Keep a few centimetres of reserve to allow for possible adjustment. In order to maintain the continuity of the profiles, at the points where they are joined one after the other, use the K-02 connector by applying it to the ends of two adjacent profiles. Screw the connector together using two screws from K-19 "T-bolts" – Fig. 12. Profiles can be cut to the required length.

**NOTE The minimum usable length of profiles in a structure is 500 mm.**

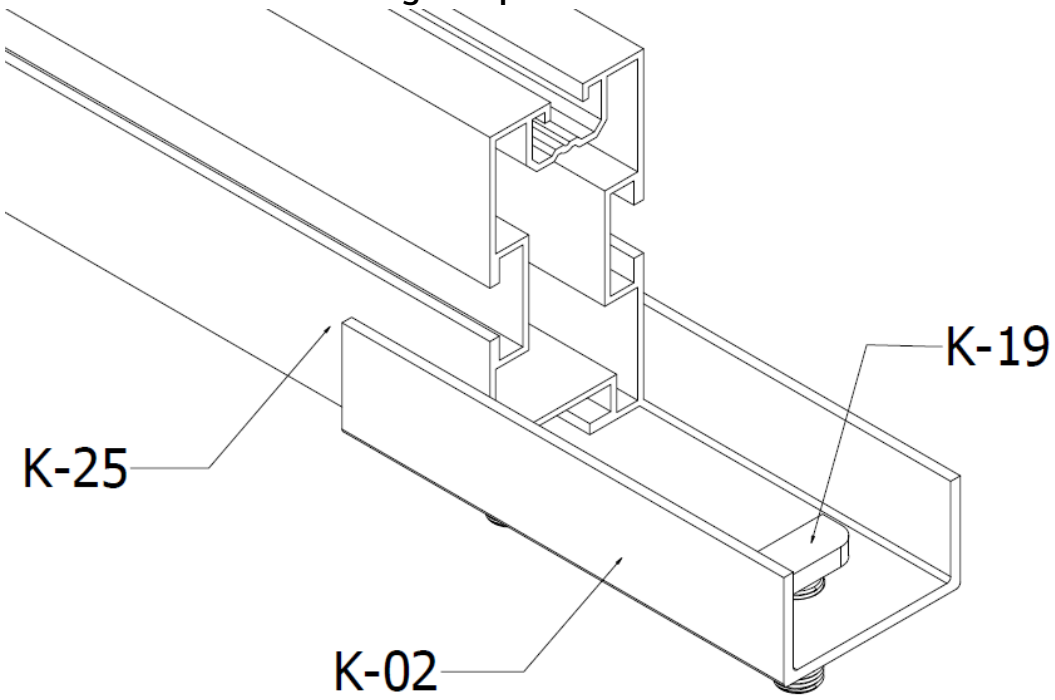



*FIG. 12. Assembly of K-02 connector with K-25 profile*

**12.** K-02 switches cannot be installed in a single line.

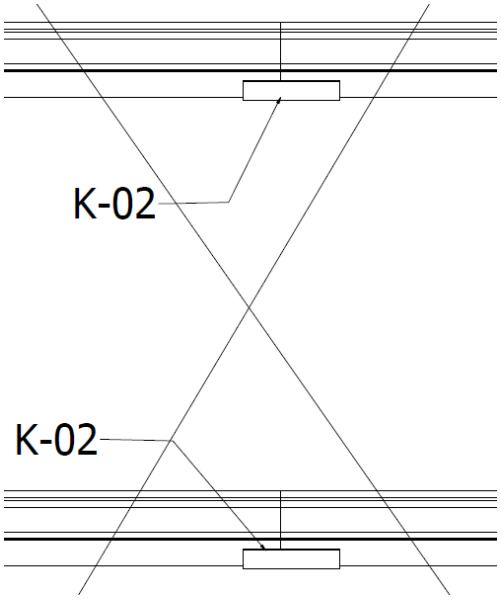
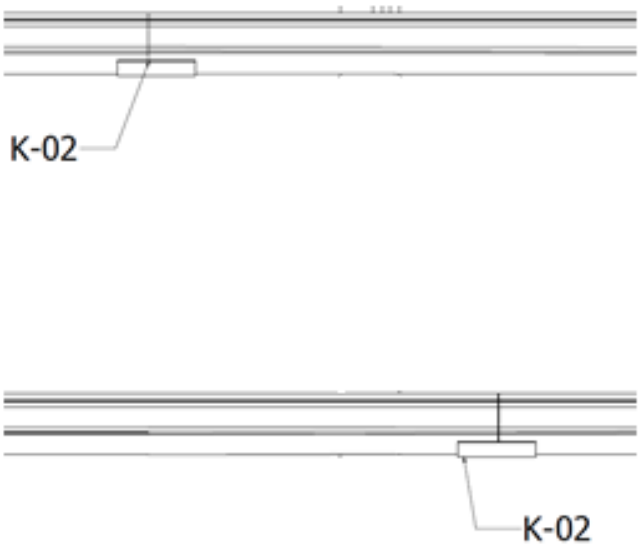



FIG. 13. Incorrect installation of K-02 connectors




Correct installation of K-02 connectors

**13.** In the next step, the pre-prepared K-25 profiles should be screwed to the K-22-XL-15 rafters using K-19 T-bolts and K-21 nuts – Figs. 14 – 15.

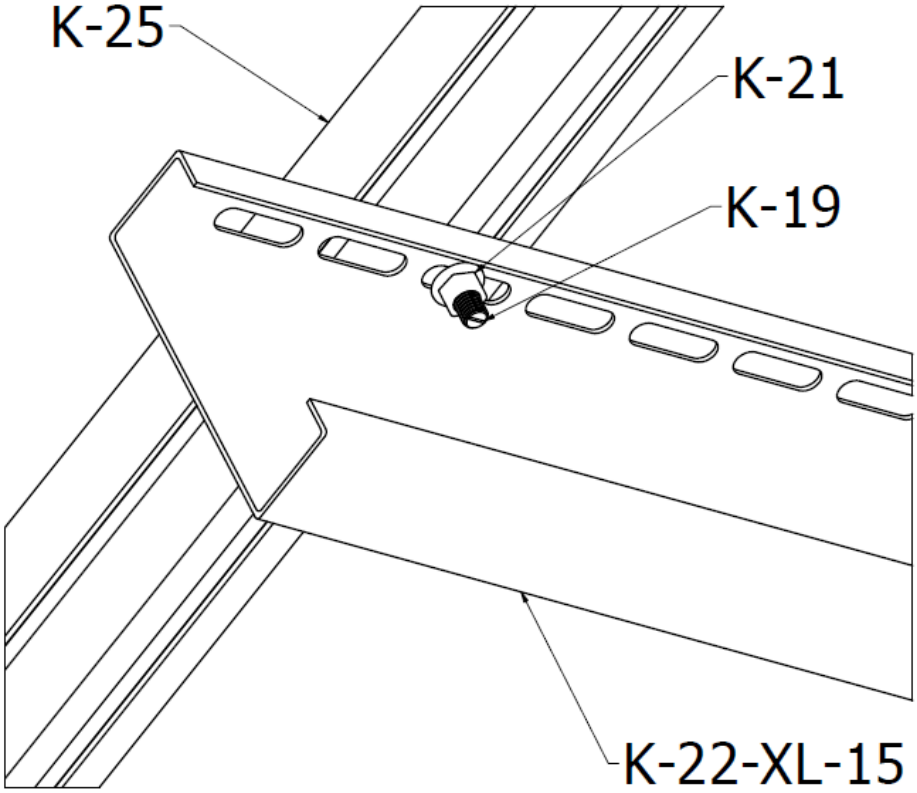



*FIG. 14. Assembly of K-01 profile to K-22-XL-15 coir*

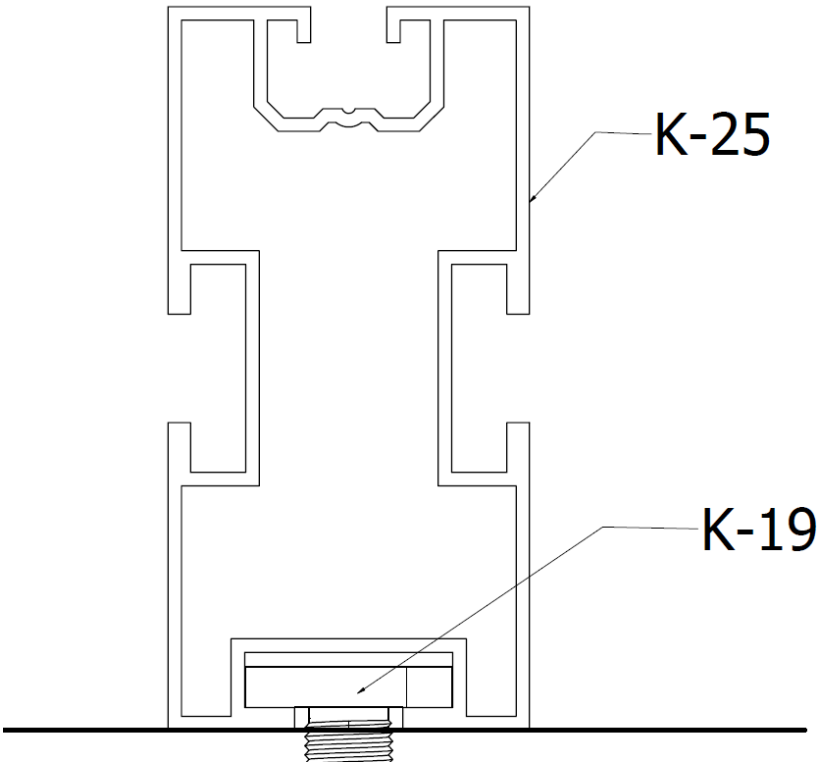



*FIG. 15. Installation of K-25 profiles*

**14.** The spacing between the consecutive support profiles must be within the installation zones of the respective module (see module installation instructions). Select the appropriate holes by laying the individual rows of profiles on the rafter beam.

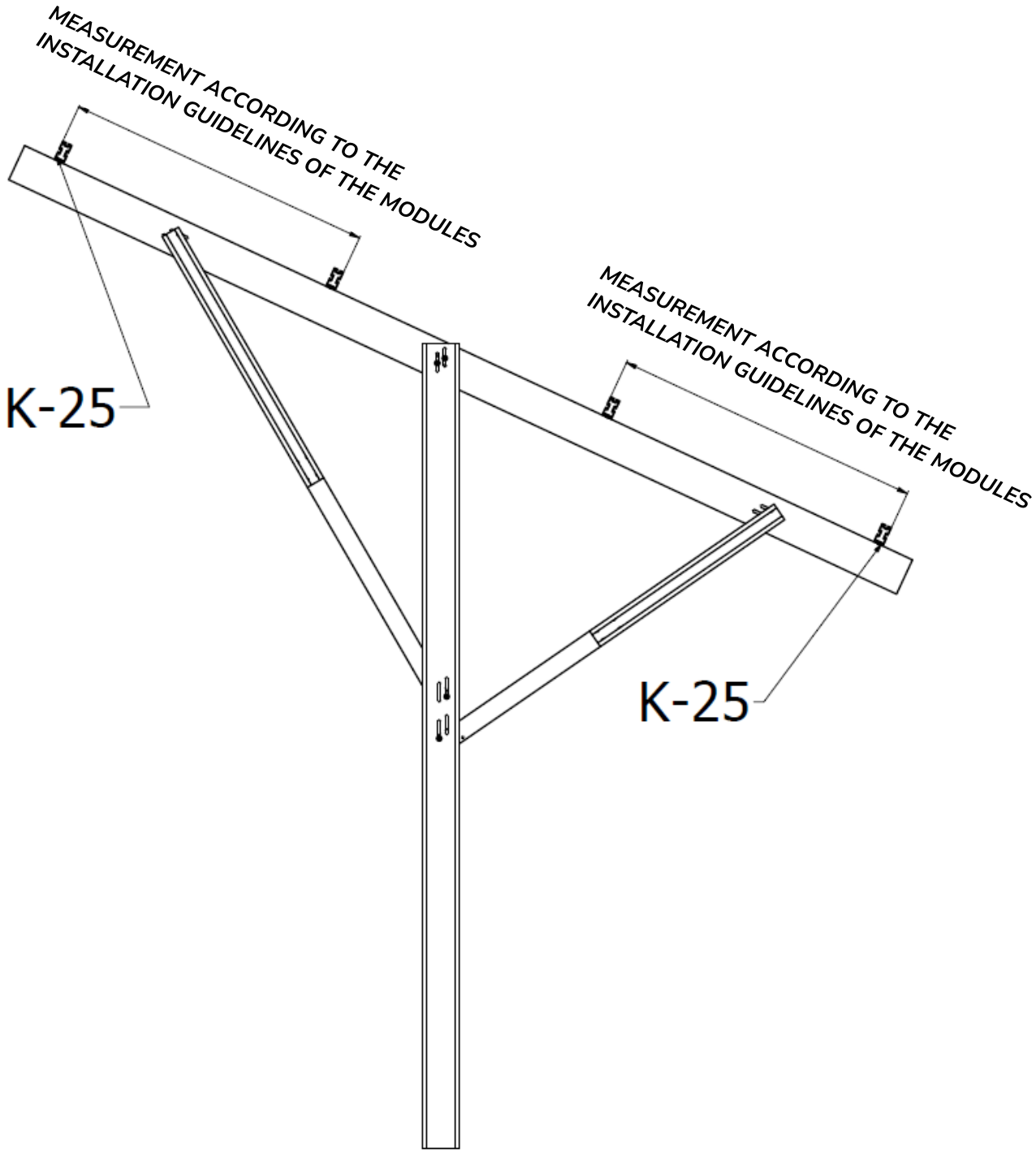



*FIG.16. Spacing of K-25 mounting profiles*

**15. The structure prepared in this way should be tightened with a torque of 30 Nm**.

**16.** To the structure prepared in this way, the K-04 inlet can be installed in a specially prepared channel. It can be installed in any desired location.

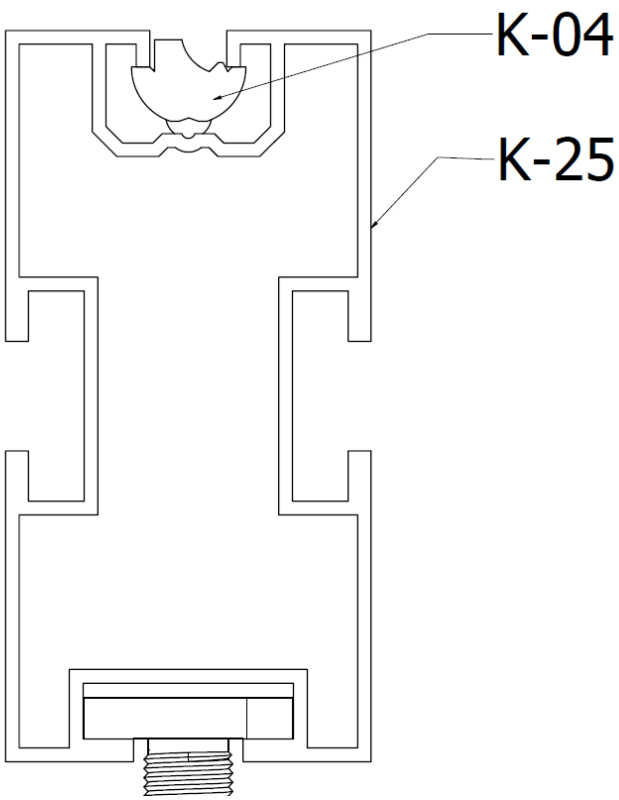



*FIG. 17. Assembly of K-04 gully to K-01 profiles*

**17.** Next, insert the K-06 end clamps into the first beam with the K-18 Allen bolts The first edge and the last will always be the end clamp, stabilising the edge of the first and last row of modules. The centre clamps, on the other hand, will simultaneously stabilise the sides of the two modules. A correctly selected end clamp will have a height equal to the module thickness, the Allen bolts will be 10mm shorter than the module thickness, the centre clamp is universal and fits any module thickness.

**NOTE: Remember to distribute the weight of the modules evenly throughout the structure.**

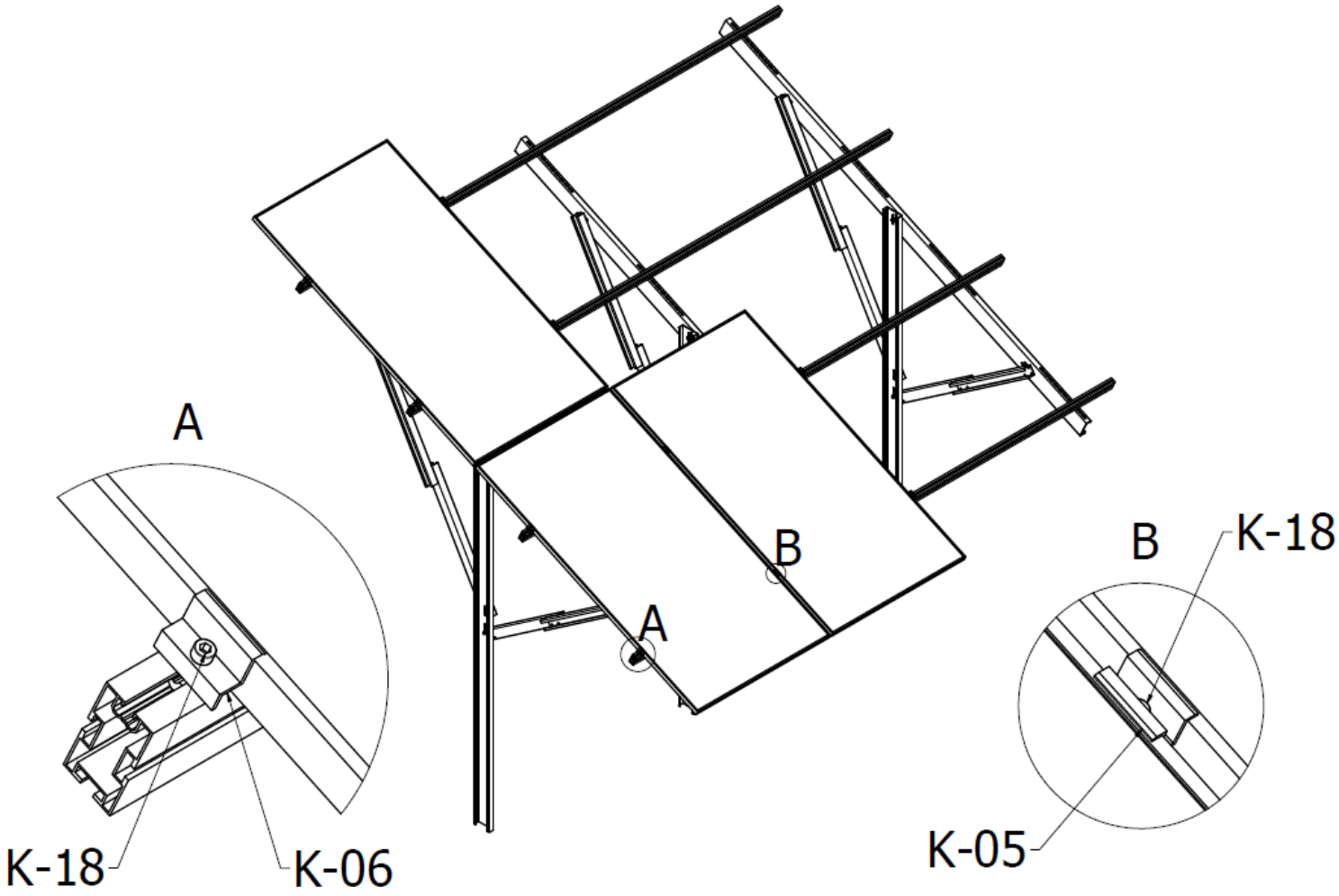



*FIG. 18. Assembly of modules and mounting of K-05 and K-06 clamps*

**18.** The modules should be assembled row by row starting from the bottom row and after initial tightening of the following consecutive clamps. Centre clamps can be used as a spacer between the modules for mounting at equal intervals in the next row, and should be pulled out after installation – Fig. 19.

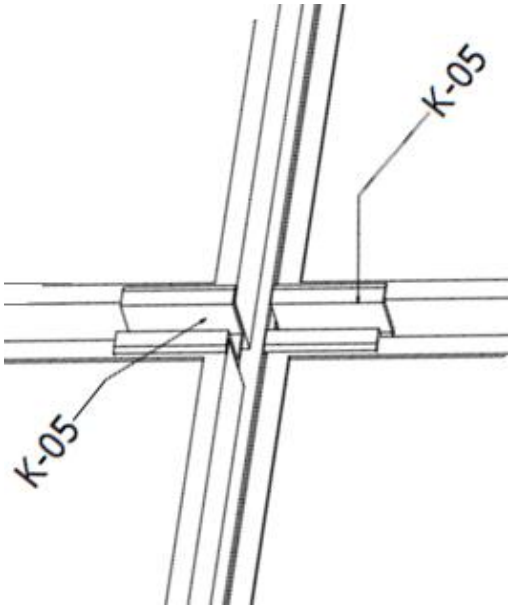



*FIG. 19. Assembling the modules to maintain an even distance*

**19. The clamps should be tightened to a torque of 18 Nm.**

## 20.Installation of stays

To the supports prepared in this way, you have to screw the braces in the form of a K-01 profile to the rear of the structure in specially prepared holes, one each in the lower and upper part of the support, using a K-19 T-bolt mounted in the specially prepared profile channel and a K-21 nut. Always place one brace each on the left and right side of a given table - Fig.20.

**Caution: trim the excess by keeping 10 mm of the profile protruding beyond the support.**

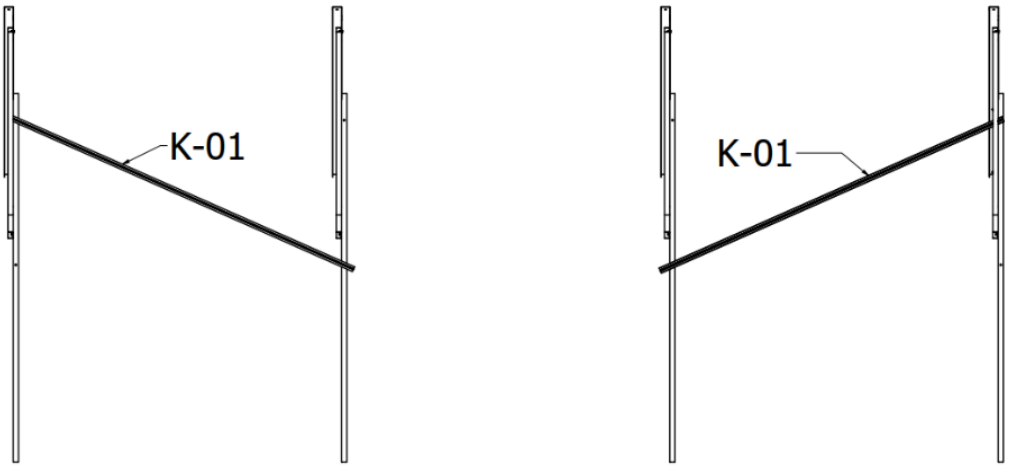



*FIG. 20. View of the installed braces for the K-22-M-13 supports*

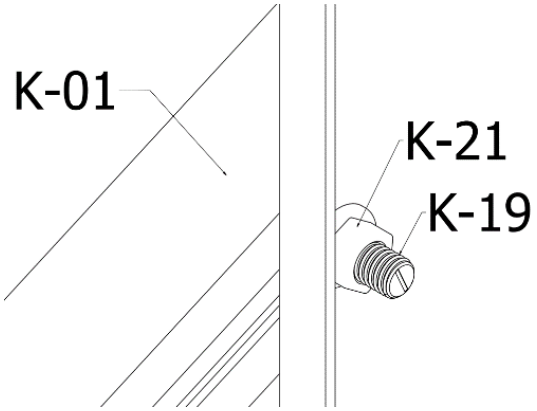



*FIG. 21. Installation of K-01 profiles (projection I)*

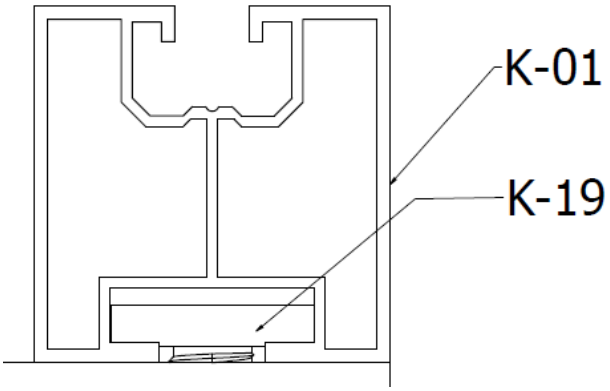



*FIG. 22. Installation of K-01 profiles (projection II)*

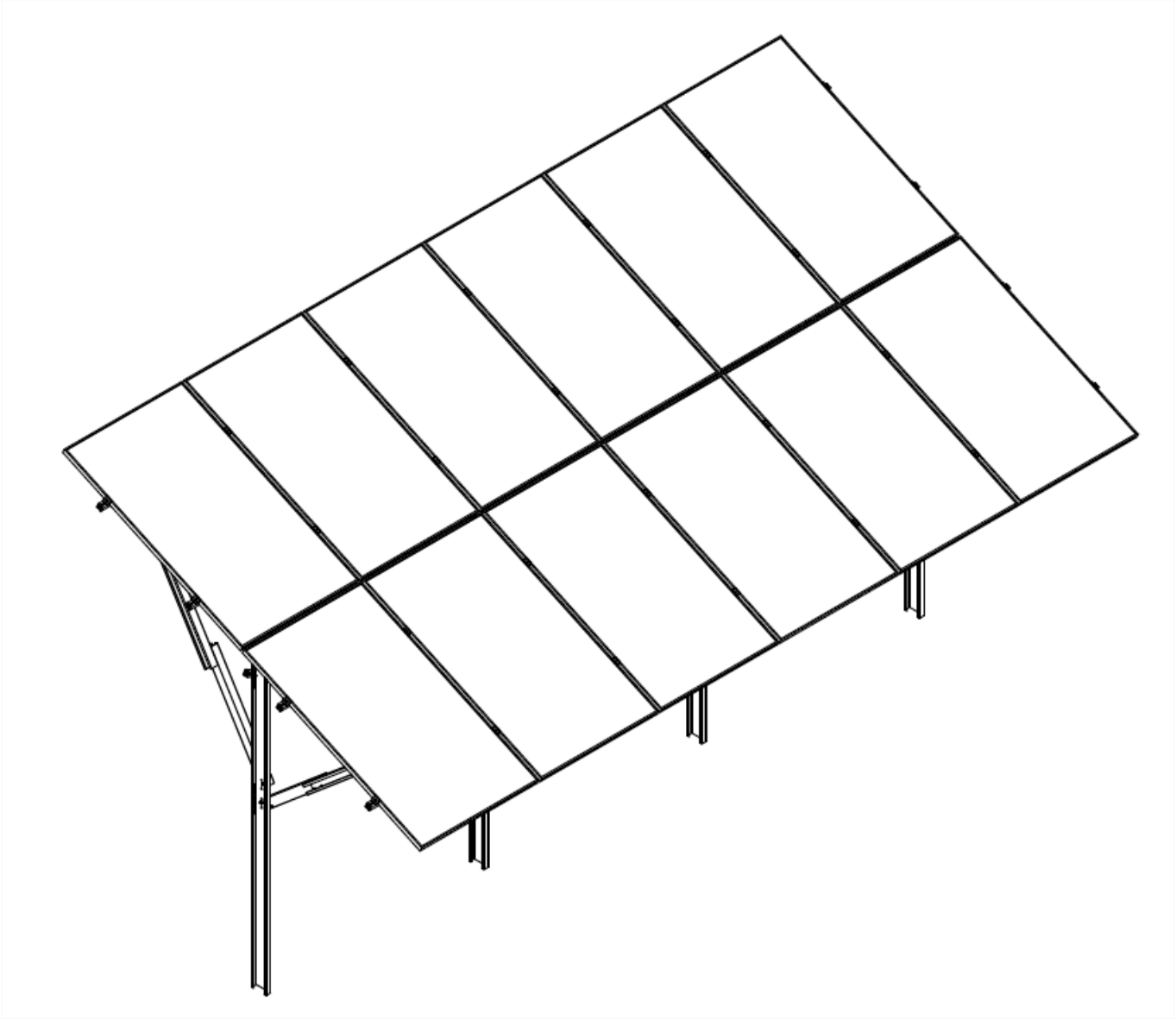


*FIG. 23. View of the assembled structure*

**Thank you for using the KENO Sp. z o.o. design.**