ASSEMBLY
INSTRUCTION

TWO-SUPPORT STRUCTURAL FRAME

EL-SUN KONSTRUKCJE

Max. module dimension:	**2500x1140 mm**
Location:	**I-III snow, I and III wind <300m asl.**

Instruction dated July 3, 2024, adapted to the calculator dated 26.06.2024 and later.

2P5HMMW
2P5HMBW

FREE-STANDING STRUCTURES

SGS ISO 14001 LL-C (Certification) ISO 9001 LL-C (Certification) CE
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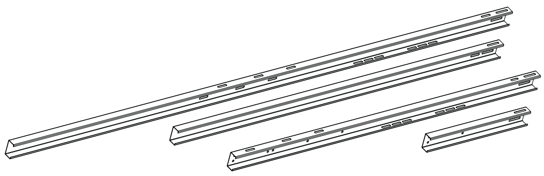
1 GROUPS OF ELEMENTS

Before starting the assembly, divide the steel elements into groups according to the table below. Verify with the order whether the quantity of elements is correct.

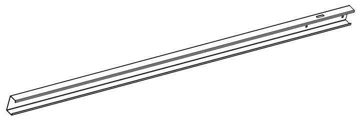
Posts

CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
SP	**P140C25**	Front post	C100x50x12	2500
ST	**P140C37**	Rear post	C100x50x12	3770
SP	**P154C20**	Front post to adapter	C93x43x13	2070
ST	**P154C08**	Rear post to adapter	C93x43x13	800



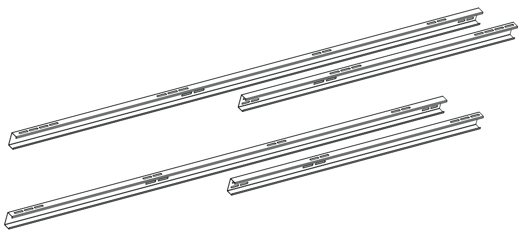
Adapter słupa

CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
SA	**P153C200**	Post adapter	C100x50x13	2000



Rygle*

CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
R	**P159C38**	Beam 5 horizon	C100x50x12	3800
R	**P159C35**	Beam 5 horizon	C100x50x12	3500
R	**P159C21**	Beam 5 horizon	C100x50x12	2100
R	**P159C19**	Beam 5 horizon	C100x50x12	1900

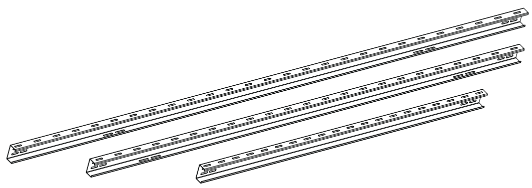


**Beams from the P147C group of similar length can be used interchangeably; however, this requires the use of the universal connector P142L03 and purlins from the P141C group, while omitting the beam-to-purlin bracket. The purlins are attached directly to the beam using a bolt.*

***NOTE!** Purlins from the P156C group must not be attached to beams from the P147C group, as they do not have the appropriate hole pattern on the lower flange of the profile.*

Support profiles*

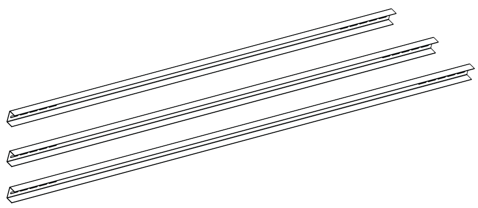
CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
P	**P156C40**	Support profiles	C100x50x12	4000
P	**P156C33**	Support profiles	C100x50x12	3300
P	**P156C22**	Support profiles	C100x50x12	2200



**Purlins from the P141C group of the same length can be used interchangeably; however, this requires the use of the universal connector P142L03.*

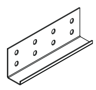
Braces

CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
ZTT	**P145C29**	Back-to-back brace	C60x35	2950
ZTT	**P143C33**	Back-to-back brace	C60x35	3300
ZTT	**P143C36**	Back-to-back brace	C60x35	3600



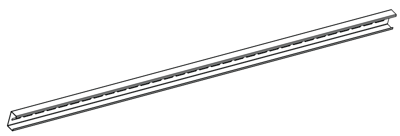
Brackets

CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
LU	**P160L03**	Universal bracket	L90x44x12	300



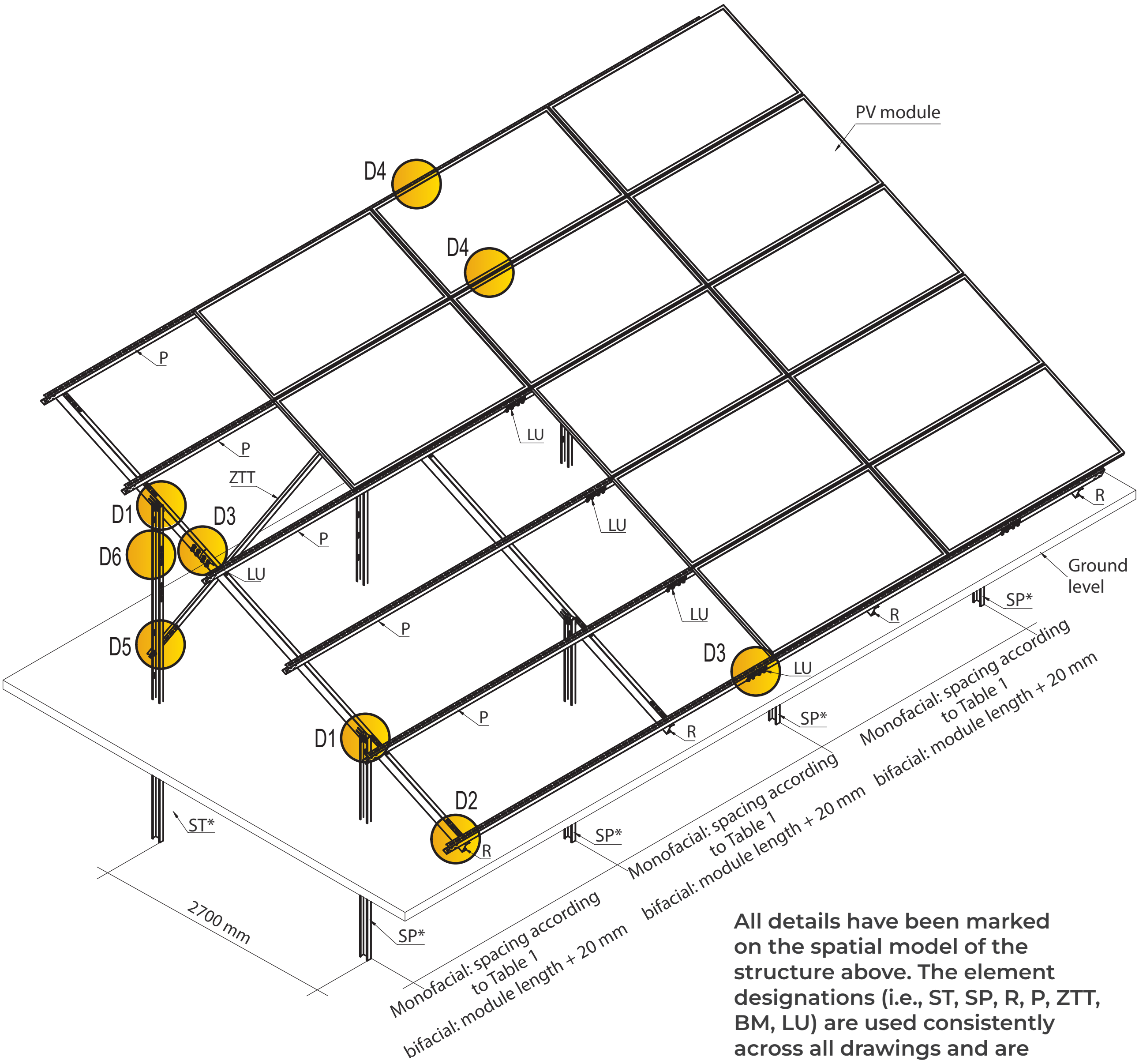
Mounting beams

CODE	NUMBER	NAME	DESCRIPTION	LENGTH [mm]
BM	**P139C33**	Mounting beam	C97x48x15	3300



2 SPATIAL MODEL OF THE STRUCTURE

Refer to the assembly instructions. In the model below, mounting details are marked with yellow circles and shown in detail on the following pages. Arrows indicate the locations of the individual elements from page 2. Pages 4-7 feature assembly drawings, followed by detailed mounting instructions.



All details have been marked on the spatial model of the structure above. The element designations (i.e., ST, SP, R, P, ZTT, BM, LU) are used consistently across all drawings and are compatible with each other.

Work sequence:

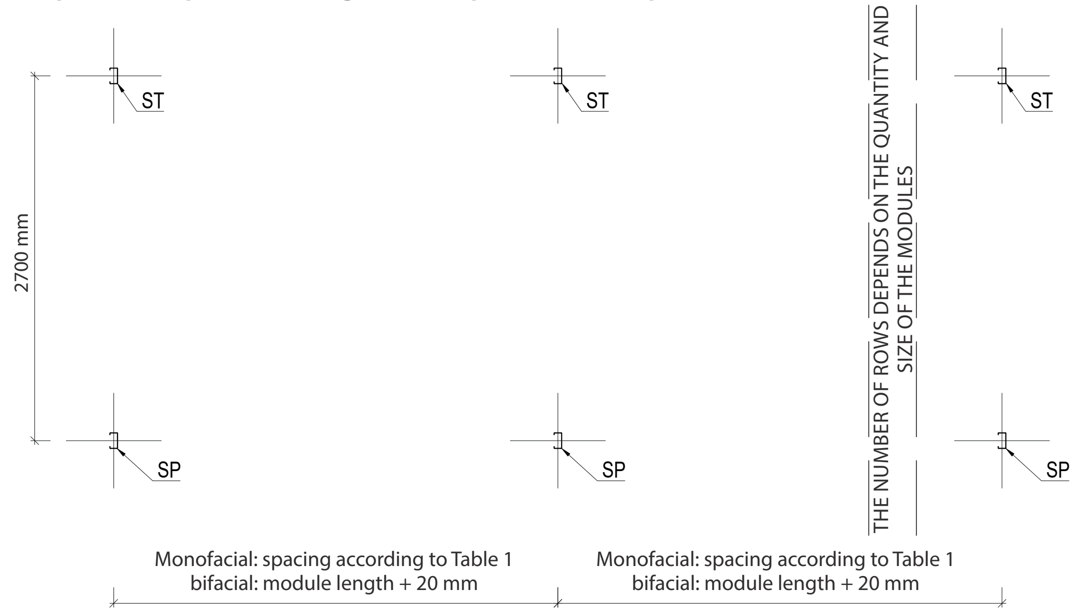
1. Lay out the posts according to the TOP VIEW - POST ARRANGEMENT (SECTION C-C) on page 4.
2. Drive the posts into the ground following the information on pages 4-7.
3. Attach the beams to the posts according to Detail D1.
4. Select the required purlin lengths from Table 3 (for monofacial modules) or Table 4 (for bifacial modules), fasten them together according to detail D3, and attach them to the beams according to detail D2. Use the information on pages 6-9.
5. Attach the braces according to Detail D5 in the plane shown on page 5.
6. Optionally, attach the mounting beams according to Detail D6 in the plane shown on page 5.
7. Attach the modules and, optionally, install the grounding plates according to Detail D4.

**It is possible to use a foldable post (assembly details in Detail D7) or other types of foundations (optional solutions available upon special request).*

3 ASSEMBLY DRAWING (TOP VIEW OF THE STRUCTURE)

BIFACIAL: Calculate the longitudinal spacing of the structure using formula 1.
MONOFACIAL: Calculate the table length using formula 2 and select the longitudinal spacing of the structure from Table 1.
Then, align all posts according to the drawing below and mark the location of the posts. Drive the posts into the ground to a minimum depth of 1.5 m. The depth of the posts depends on the target tilt angle of the modules and the soil conditions. Ensure vertical alignment of the posts during installation. Avoid damaging the posts while driving them in; using a spacer is recommended. Posts can be anchored into the ground using a pile driver.

Top view – post arrangement (section C-C)



BIFACIAL (formula 1):
LONGITUDINAL SPACING [mm] = module length in mm + 20 (formula 1)

MONOFACIAL (formula 2):
TABLE LENGTH [mm] = (number of modules / 5) * (module length in mm + 20) - 20

Set all posts in the orientation shown in the drawing.

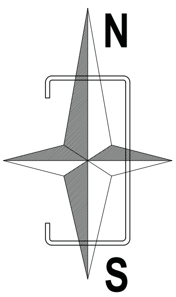


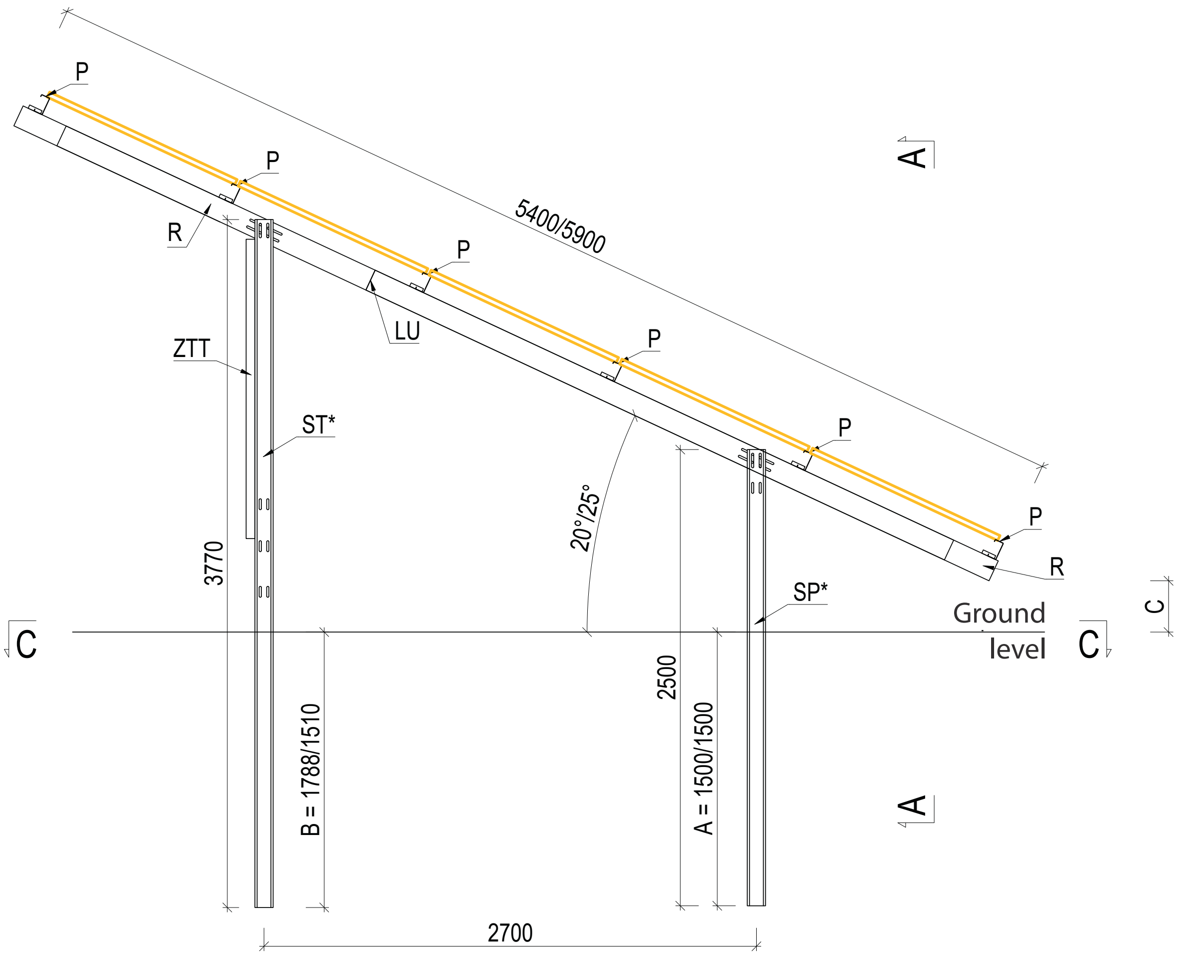
Table 1. Selection of longitudinal spacing

TABLE LENGTH [MM]	LONGITUDINAL SPACING [MM]
0 - 2 900	2 100
2 901 - 4 900	3 000
4 901 - 6 200	2 100
6 201 - 8 000	3 000
8 001 - 9 500	2 500
9 501 - 10 900	3 000
10 901 - 12 000	2 600
12 001 - 12 700	2 800
12 701 - 13 900	3 000
13 901 - 14 900	2 600
14 901 - 15 700	2 800
15 701 - 16 800	3 000
16 801 - 17 500	2 600
17 501 - 18 600	2 800
18 601 - 20 000	3 000
20 001 - 20 100	2 600
20 101 - 21 600	2 800
21 601 - 23 000	3 000
23 001 - 24 000	2 800
24 001 - 24 700	2 900
24 701 - 25 600	3 000

4 ASSEMBLY DRAWING (WEST VIEW OF THE STRUCTURE)

Refer to the side view and Table 2 to determine the post embedding depth based on the selected target tilt angle of the modules. Pay attention to the positioning of the purlins on the beam – profiles are oriented with their openings facing north. The side view also shows the mounting planes for the BM (mounting beams) and ZTT (braces).

Side view – from the west (section B-B)



NOTE 1: Arrange the purlins on the beams according to the assembly instructions for the selected PV module – adjust to the mounting zones.

NOTE 2: Set the purlins as shown in the drawing, always with the opening facing north.

NOTE 3: For a table of a specific length, select the purlins according to Table 3. or Table 4. Ensure that the purlin connections do not align directly over the posts or in the middle of the span.

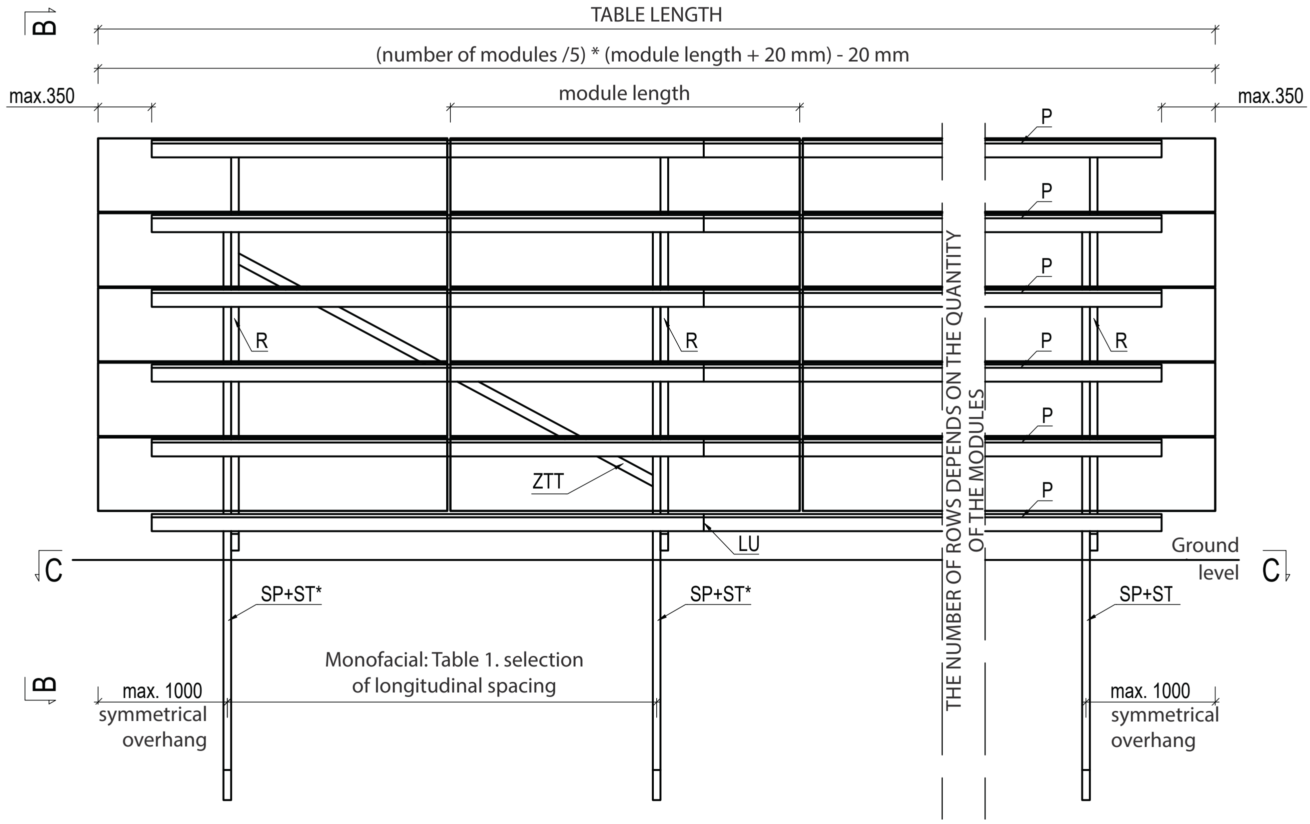
Table 2. Structure geometry depending on the tilt angle

ANGLE	DRIVING DEPTH [MM]		HEIGHT OF BEAM BASE ABOVE GROUND [MM] – „C”	
	„B” ST	„A” SP	P159C19 + P159C35	P159C21 +P159C38
20°	1788	1500	~552	~366
25°	1510	1500	~447	~268

5 ASSEMBLY DRAWING (SOUTH VIEW OF THE STRUCTURE)

MONOFACIAL: The front view shows the maximum module overhang beyond the end of the purlin – 350 mm, and the maximum module overhang from the post axis – 1 m. When installing purlins, aim for equal overhangs on both sides. To select the purlins and braces, compare the table length calculated using the formula on page 4 with the „ACTUAL TABLE LENGTH" provided in Table 3 on page 8 and choose the value that is greater than or equal to the calculated one.

Front view (section A-A) – monofacial



EXAMPLE OF SELECTING PURLINS AND BRACES:

A table for 30 modules with dimensions of 1908x1134 mm is being assembled.
Calculate the table length (page 4):

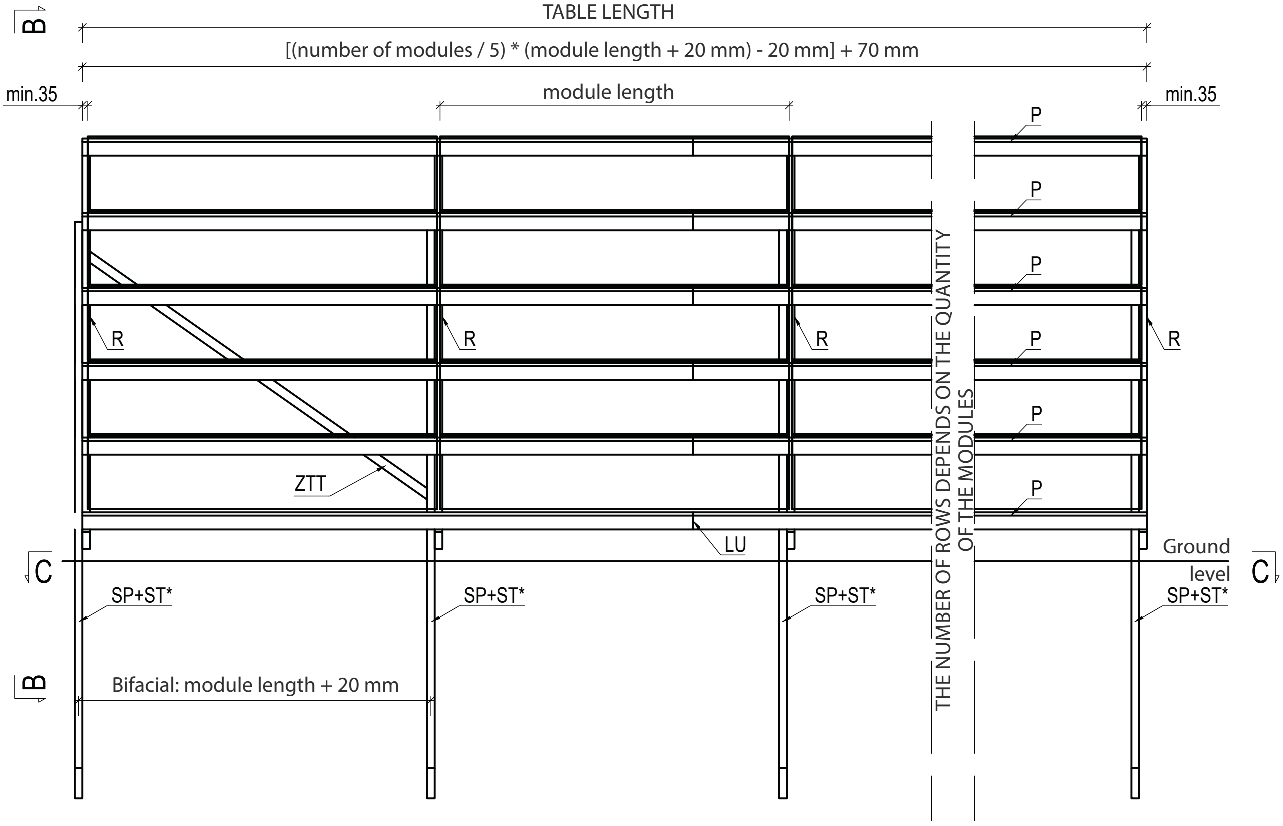
(30 modules / 5) * (1908 mm + 20) - 20 = 11 548 mm

Compare the result with the ACTUAL TABLE LENGTH in Table 3. The first value greater than or equal to the result is 11 700. Therefore, one row of purlins in the assembled table will consist of two purlin P156C33 (length 3300 mm) and two purlins P156C22 (length 2200 mm).
Additionally, from Table 3, the longitudinal spacing of the posts for this case is 2600 mm, and the brace length is 3300 mm.

6 ASSEMBLY DRAWING (SOUTH VIEW OF THE STRUCTURE)

BIFACIAL: The beams are mounted at the centerlines of the gaps between the modules, and the purlins extend beyond the outline of the outermost modules by at least 35 mm on each side. To select the purlins and braces, compare the table length calculated using the formula on page 4, increased by 70 mm, with the „ACTUAL TABLE LENGTH" provided in Table 4 on page 9, and choose a value that is greater than or equal to the calculated length. Details on the positioning and method of joining the purlins are described in detail D3. The location and orientation of the braces are described in detail D5.

Front view (section A-A) – bifacial



EXAMPLE OF SELECTING PURLINS AND BRACES:
A table for 30 modules with dimensions of 1908x1134 mm is being assembled.
Calculate the table length (page 4):

[(30 modules / 5) * (1908 mm + 20) - 20 mm] + 70 mm = 11 618 mm

Compare the result with the ACTUAL TABLE LENGTH in Table 3. The first value greater than or equal to the result is 11 700. Therefore, one row of purlins in the assembled table will consist of one purlin P156C40 (length 4000 mm), one purlin P156C33 (length 3300 mm) and two purlins P156C22 (length 2200 mm) Additionally, from Table 4, the brace length is 2950 mm.

TABLE 3. SELECTION OF PURLIN LENGTHS AND BACK-TO-BACK BRACES (MONOFACIAL)

ACTUAL TABLE LENGTH	P156C40	P156C33	P156C22	LONGITUDINAL SPACING BETWEEN POSTS	BACK-TO--BACK BRACE ZTT
25600	1	5	2	3000	3600
25500	4	2	1	3000	3600
25200	2	5	0	3000	3600
25100	5	0	2	3000	3600
24900	0	4	5	3000	3600
24800	3	3	1	3000	3600
24700	6	0	0	2900	3600
24500	1	6	0	2900	3600
24400	4	1	2	2900	3600
24100	2	4	1	2900	3600
24000	5	1	0	2800	3300
23800	0	5	3	2800	3300
23700	3	2	2	2800	3300
23400	1	5	1	2800	3300
23300	4	2	0	2800	3300
23000	2	3	2	3000	3600
22900	5	0	1	3000	3600
22700	0	4	4	3000	3600
22600	3	3	0	3000	3600
22300	1	4	2	3000	3600
22200	4	1	1	3000	3600
21900	2	4	0	3000	3600
21600	0	5	2	2800	3300
21500	3	2	1	2800	3300
21200	1	5	0	2800	3300
21100	4	0	2	2800	3300
20800	2	3	1	2800	3300
20700	5	0	0	2800	3300
20500	0	4	3	2800	3300
20400	3	1	2	2800	3300
20100	1	4	1	2600	3300
20000	4	1	0	3000	3600
19700	2	2	2	3000	3600
19400	0	5	1	3000	3600
19300	3	2	0	3000	3600
19000	1	3	2	3000	3600
18900	4	0	1	3000	3600
18600	2	3	0	2800	3300
18300	0	4	2	2800	3300
18200	3	1	1	2800	3300

ACTUAL TABLE LENGTH	P156C40	P156C33	P156C22	LONGITUDINAL SPACING BETWEEN POSTS	BACK-TO--BACK BRACE ZTT
17900	1	4	0	2800	3300
17500	2	2	1	2600	3300
17200	0	5	0	2600	3300
17100	3	0	2	2600	3300
16800	1	3	1	3000	3600
16700	4	0	0	3000	3600
16400	2	1	2	3000	3600
16100	0	4	1	3000	3600
16000	3	1	0	3000	3600
15700	1	2	2	2800	3300
15300	2	2	0	2800	3300
15000	0	3	2	2800	3300
14900	3	0	1	2600	3300
14600	1	3	0	2600	3300
14200	2	1	1	2600	3300
13900	0	4	0	3000	3600
13500	1	2	1	3000	3600
13100	2	0	2	3000	3600
12800	0	3	1	3000	3600
12700	3	0	0	2800	3300
12400	1	1	2	2800	3300
12000	2	1	0	2600	3300
11700	0	2	2	2600	3300
11300	1	2	0	2600	3300
10900	2	0	1	3000	3600
10600	0	3	0	3000	3600
10200	1	1	1	3000	3600
9500	0	2	1	2500	3300
9100	1	0	2	2500	3300
8700	2	0	0	2500	3300
8400	0	1	2	2500	3300
8000	1	1	0	3000	3600
7300	0	2	0	3000	3600
6900	1	0	1	3000	3600
6200	0	1	1	2100	3300
5100	0	0	2	2100	3300
4900	0	0	2	3000	3600
4700	1	0	0	3000	3600
4000	0	1	0	3000	3600
2900	0	0	1	2100	3300

It is permissible to install old P141... purlins in accordance with the guidelines provided on page 2. The purlin lengths are selected in the same way.

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TABLE 4. SELECTION OF PURLIN LENGTHS AND BRACES (BIFACIAL)

ACTUAL TABLE LENGTH	P156C40	P156C33	P156C22	BACK-TO-BACK BRACE
24900	1	5	2	2950
24800	4	2	1	2950
24500	2	5	0	2950
24400	5	0	2	2950
24100	3	3	1	2950
24000	3	3	1	2950
23800	3	3	1	2950
23700	6	0	0	2950
23400	2	4	1	2950
23300	5	1	0	2950
22900	3	2	2	2950
22700	1	5	1	2950
22600	4	2	0	2950
22300	2	3	2	2950
22200	5	0	1	2950
21900	3	3	0	2950
21600	1	4	2	2950
21500	4	1	1	2950
21200	2	4	0	2950
20900	2	4	0	2950
20800	2	4	0	2950
20500	2	4	0	2950
20400	2	4	0	2950
20200	4	0	2	2950
20100	2	3	1	2950
20000	5	0	0	2950
19700	3	1	2	2950
19400	1	4	1	2950
19300	4	1	0	2950
19000	2	2	2	2950
18700	0	5	1	2950
18600	3	2	0	2950
18300	1	3	2	2950
18200	4	0	1	2950
17900	4	0	1	2950
17500	3	1	1	2950
17200	1	4	0	2950
16800	2	2	1	2950
16500	0	5	0	2950

ACTUAL TABLE LENGTH	P156C40	P156C33	P156C22	BACK-TO-BACK BRACE
16400	3	0	2	2950
16300	3	0	2	2950
16100	1	3	1	2950
16000	4	0	0	2950
15700	2	1	2	2950
15400	0	4	1	2950
15300	3	1	0	2950
15000	3	1	0	2950
14800	1	2	2	2950
14600	2	2	0	2950
14300	0	3	2	2950
14200	3	0	1	2950
13900	1	3	0	2950
13300	1	3	0	2950
13200	0	4	0	2950
12800	1	2	1	2950
12400	2	0	2	2950
12100	0	3	1	2950
12000	3	0	0	2950
11700	1	1	2	2950
11300	2	1	0	2950
11000	0	2	2	2950
10600	0	2	2	2950
10300	1	2	0	2950
9900	0	3	0	2950
9500	1	1	1	2950
8800	0	2	1	2950
8400	1	0	2	2950
8000	1	0	2	2950
7700	1	0	2	2950
7300	1	1	0	2950
6600	0	2	0	2950
6200	1	0	1	2950
5400	0	1	1	2950
4300	0	0	2	2950
4000	1	0	0	2950
3300	0	1	0	2950
2700	0	1	0	2950
2200	0	0	1	2950

It is permissible to install old P141... purlins in accordance with the guidelines provided on page 2. The purlin lengths are selected in the same way.

9 DETAIL OF CONNECTION BETWEEN POST ST/SP-BEAM R

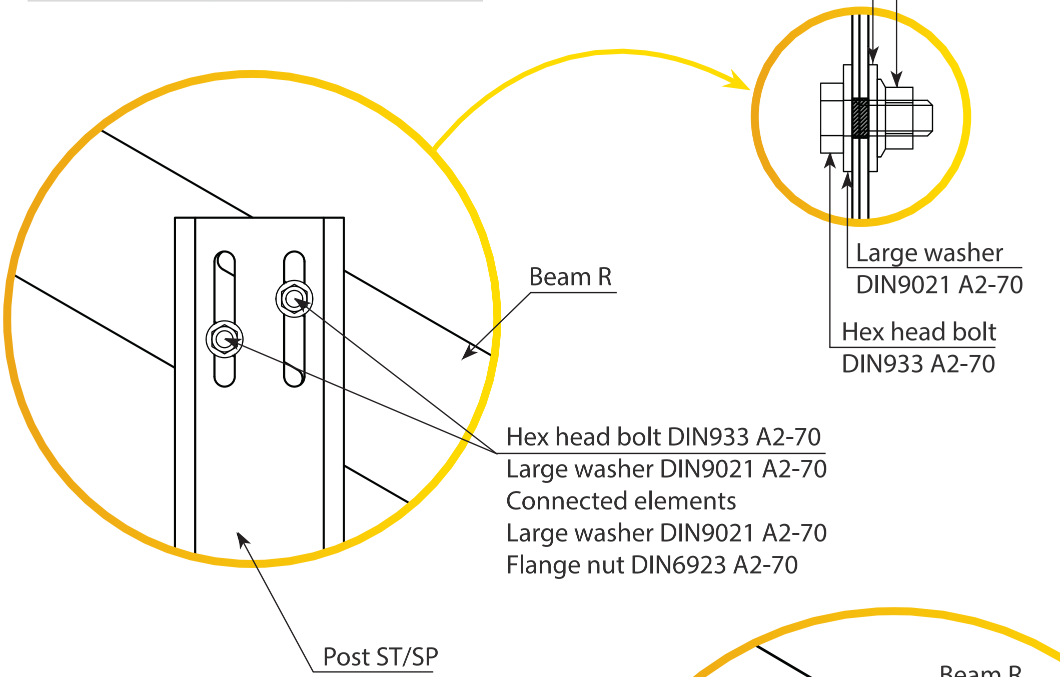
D1

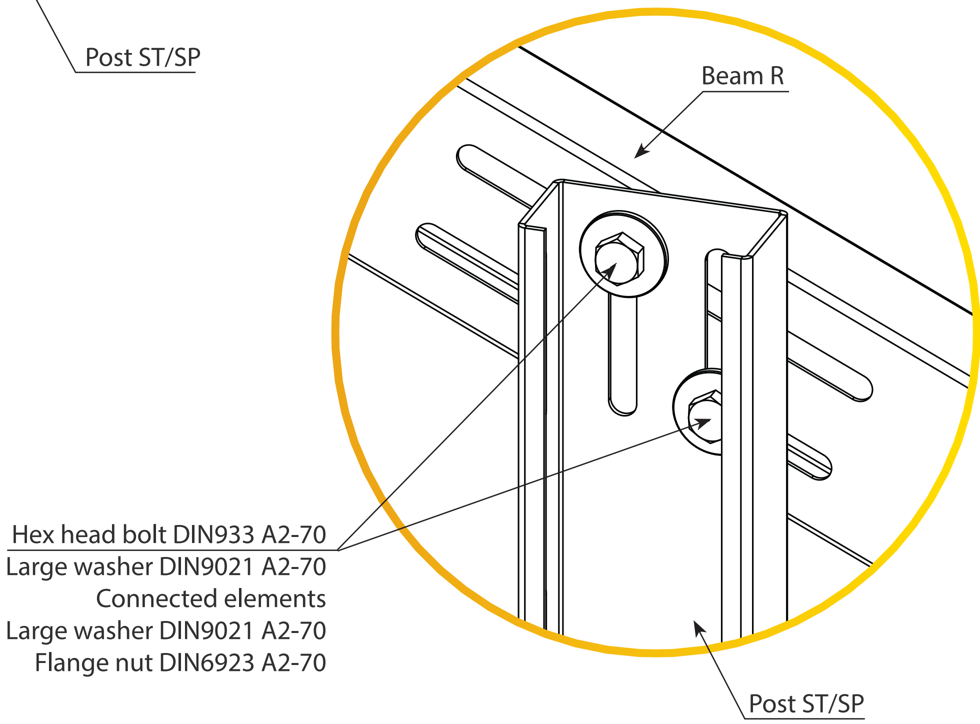
For one connection, you will need:

- 2x hex head bolt DIN933 A2-70
- 4x large washer DIN9021 A2-70
- 2x flange nut DIN6923 A2-70

Attach the beam R to the correctly driven ST and SP posts from the east side. Remember to maintain the correct tilt angle of the beam, as it will determine the tilt angle of the modules. The torque values for tightening the bolts are provided in the table below.

Bolt torque Md [Nm]		
M12 A2 DIN933	kl.70	57
M10 A2 DIN933	kl.70	33
M8 A2 DIN912	kl.70	15





10 DETAIL OF CONNECTION BEAM R-PURLIN P

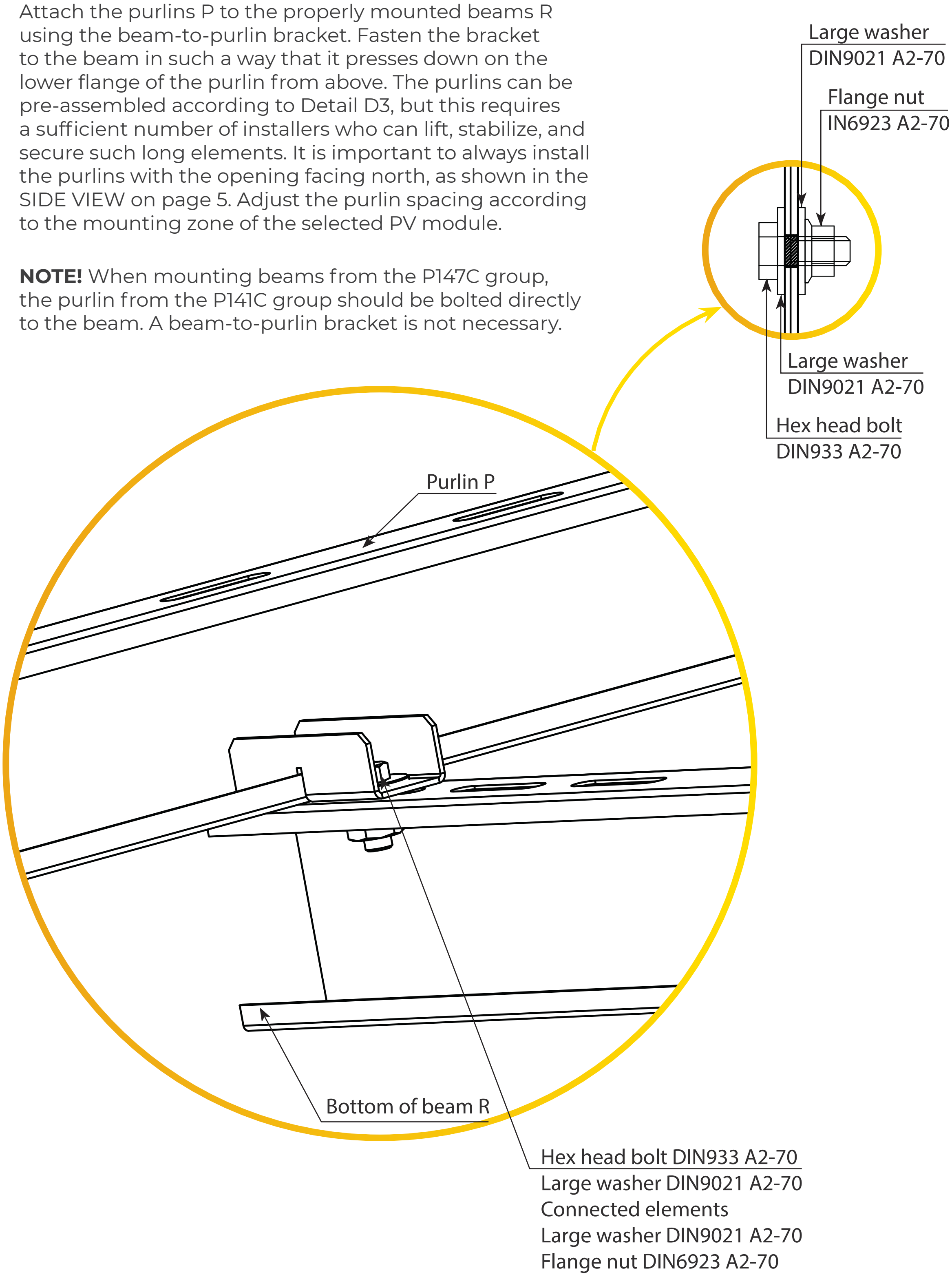
D2

For one connection, you will need:

- 1x hex head bolt DIN933 A2-70
- 2x large washer DIN9021 A2-70
- 1x flange nut DIN6923 A2-70
- 1x beam-to-purlin bracket

Attach the purlins P to the properly mounted beams R using the beam-to-purlin bracket. Fasten the bracket to the beam in such a way that it presses down on the lower flange of the purlin from above. The purlins can be pre-assembled according to Detail D3, but this requires a sufficient number of installers who can lift, stabilize, and secure such long elements. It is important to always install the purlins with the opening facing north, as shown in the SIDE VIEW on page 5. Adjust the purlin spacing according to the mounting zone of the selected PV module.

NOTE! When mounting beams from the P147C group, the purlin from the P141C group should be bolted directly to the beam. A beam-to-purlin bracket is not necessary.



Variant: **2P5HMMW, 2P5HMBW**

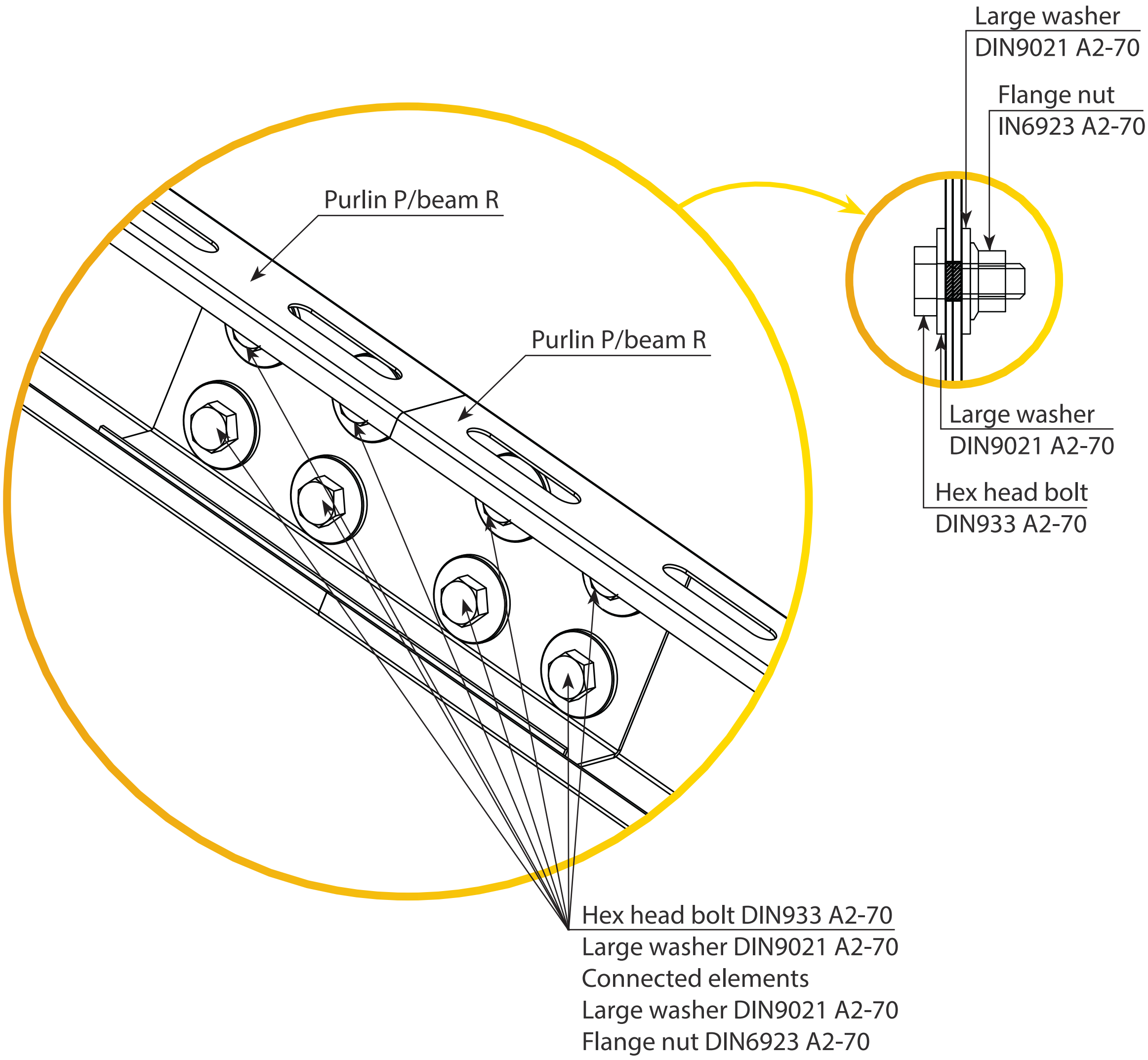
11 DETAIL OF CONNECTION PURLIN P-PURLIN P/BEAM R – BEAM R

D3

For one connection, you will need:
- 8x hex head bolt DIN933 A2-70
- 16x large washer DIN9021 A2-70
- 8x flange nut DIN6923 A2-70
- 1x universal joiner S350GD

Before connecting the purlins, refer to page 8 or 9 to determine which profiles will make up one row of purlins. Arrange them in such a way as to avoid connecting purlins directly above the posts or in the middle of the span, and to ensure symmetrical overhang beyond the outline of the last posts. If it is not possible to avoid connecting purlins above a post, rotate the joiner with the flange facing up to avoid collision with the purlin-to-beam bracket. Purlins can be connected prior to attaching them to the beams; however, this requires a sufficient number of installers capable of lifting, stabilizing, and securing such long elements. Alternatively, they can be mounted individually and connected during installation on subsequent beams. In the case of a monofacial structure, the module may extend up to 350 mm beyond the purlin, while in the case of a bifacial structure, the purlin must extend at least 35 mm beyond the module outline. The purlin must not extend more than 1 m beyond the axis of the last post.

NOTE! For purlins from the P141C... group (with perforated lower flanges along the entire length) and for beams from the P147C... group, use the P142L03 joiner with a length of 260 mm. For purlins from the P156C... group (without perforation of the lower flange along the entire length) and for beams from the P159C... group, use the P160L03 joiner with a length of 300 mm.



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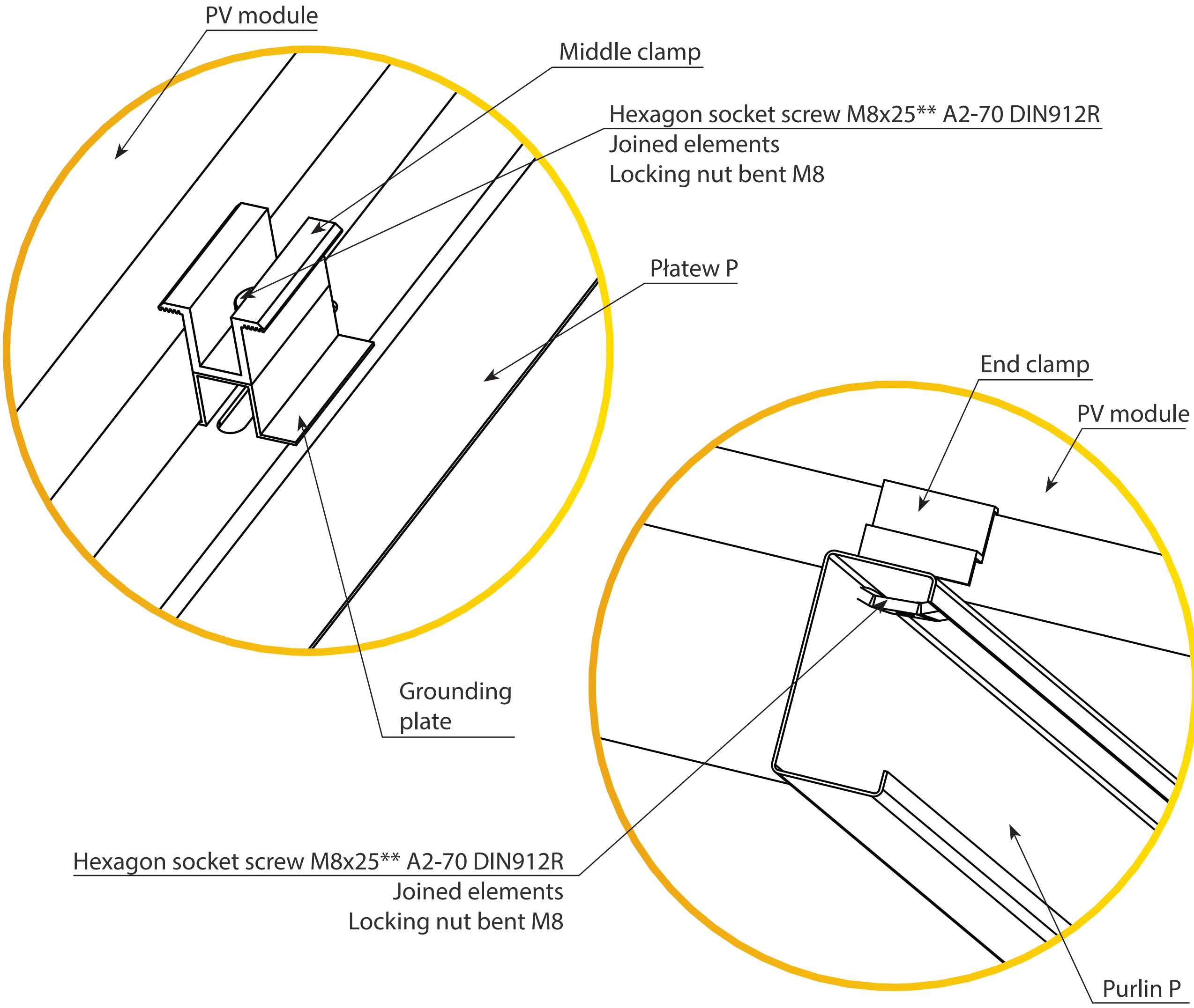
12 DETAIL OF CONNECTION PURLIN P-CLAMP (PV)

D4

For one connection, you will need:

- allen bolt M8x25** A2-70 DIN912R
- bracket with rivet nut for clamp
- grounding plate*

Before installing the modules, ensure that the support structure is assembled according to the assembly instructions, has the correct tilt, and is rigid. Review the installation instructions for the PV module. Check the PV module manufacturer's recommended torque for tightening Allen bolts/clamps. Verify whether the supplied clamps are compatible with the PV module being installed (color, height, and width of the clamp) and if the bolts are the correct length**. For modules with a black frame, always use grounding plates under every second middle clamp so that each module makes contact with at least one grounding plate. Grounding plates should be placed on the bracket with the rivet nut under the clamp/module. The support structure manufacturer allows only long-side mounting of the module. Clamps should not deform the frame, touch the glass surface, or cast shadows on the module. Modules should be installed in such a way that they rest freely on the structure across the entire contact area. The support structure manufacturer is not responsible for damage to modules during installation.



Variant: **2P5HMMW, 2P5HMBW**

13 DETAIL OF THE CONNECTION: COLUMN ST – BACK-BACK BRACE ZTT **D5**

For one connection, you need:

- 1x hexagon head screw DIN933 A2-70
- 2x widened washer DIN9021 A2-70
- 1x flange nut DIN6923 A2-70

For the rear columns on the northern side (the plane shown on page 5), attach the braces using the most suitable holes, trying to maintain the greatest possible span. In Table 5, the number of required braces is provided depending on the number of spans (halves between columns), the span number in which the brace is to be installed, and the direction/orientation of its installation.

Please note that the length of the brace should be selected from Table 3 (modules monofacial) or from Table 4 (modules bifacial), depending on the spacing of the columns.

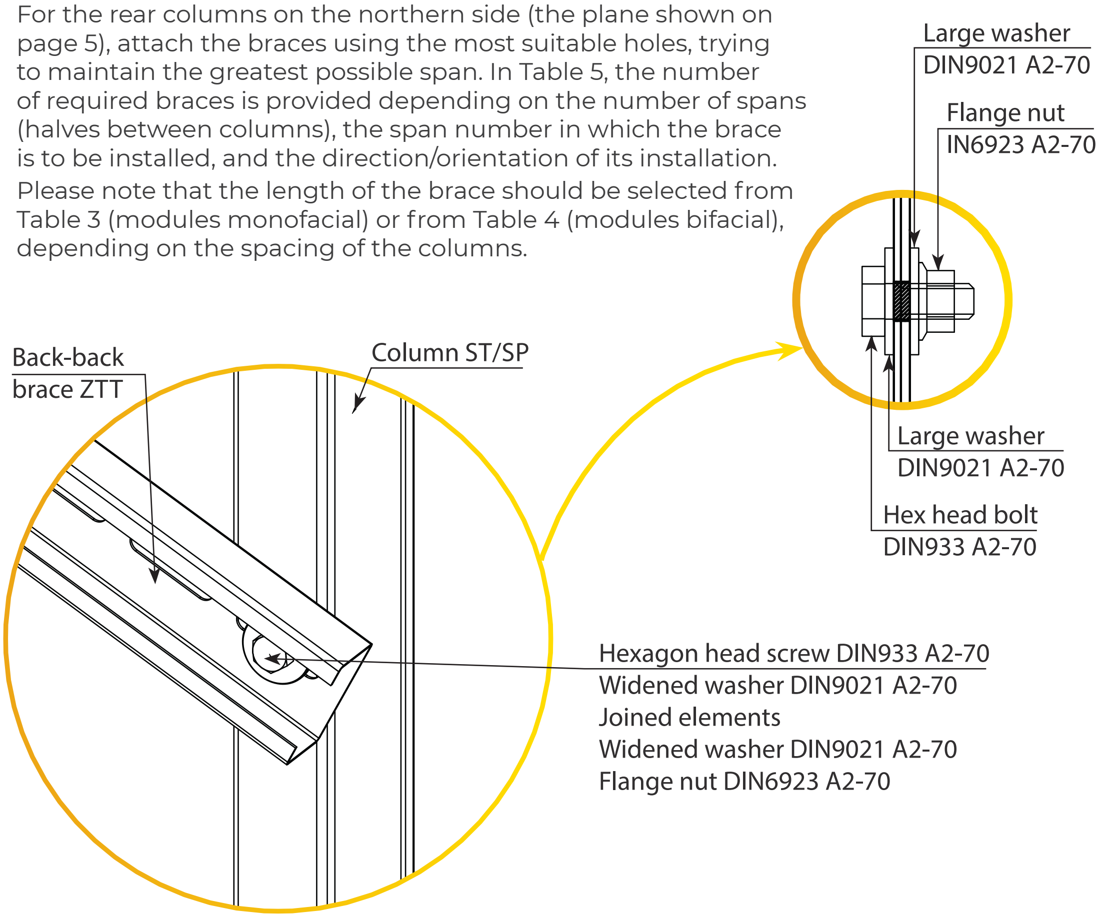
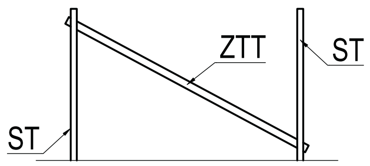


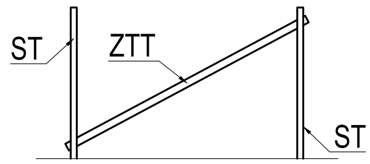
Table 5. Location and orientation of braces

NUMBER OF SPANS	NUMBER OF BRACES	SPAN WITH BRACE AND ORIENTATION
1-2	1	any span (any orientation)
3	1	middle (any)
4-6	2	1st (to the left) + last (to the right)
7-9	3	1st (to the left) + 5th (any) + last (to the right)
10-11	4	1st (to the left) + 4th (to the right) + 7th (to the left) + last (to the right)
>11	4	1st (to the left) + 5th (to the right) + 9th (to the left) + last (to the right)

Left orientation (view from the front)



Right orientation (view from the front)



Variant: **2P5HMMW, 2P5HMBW**

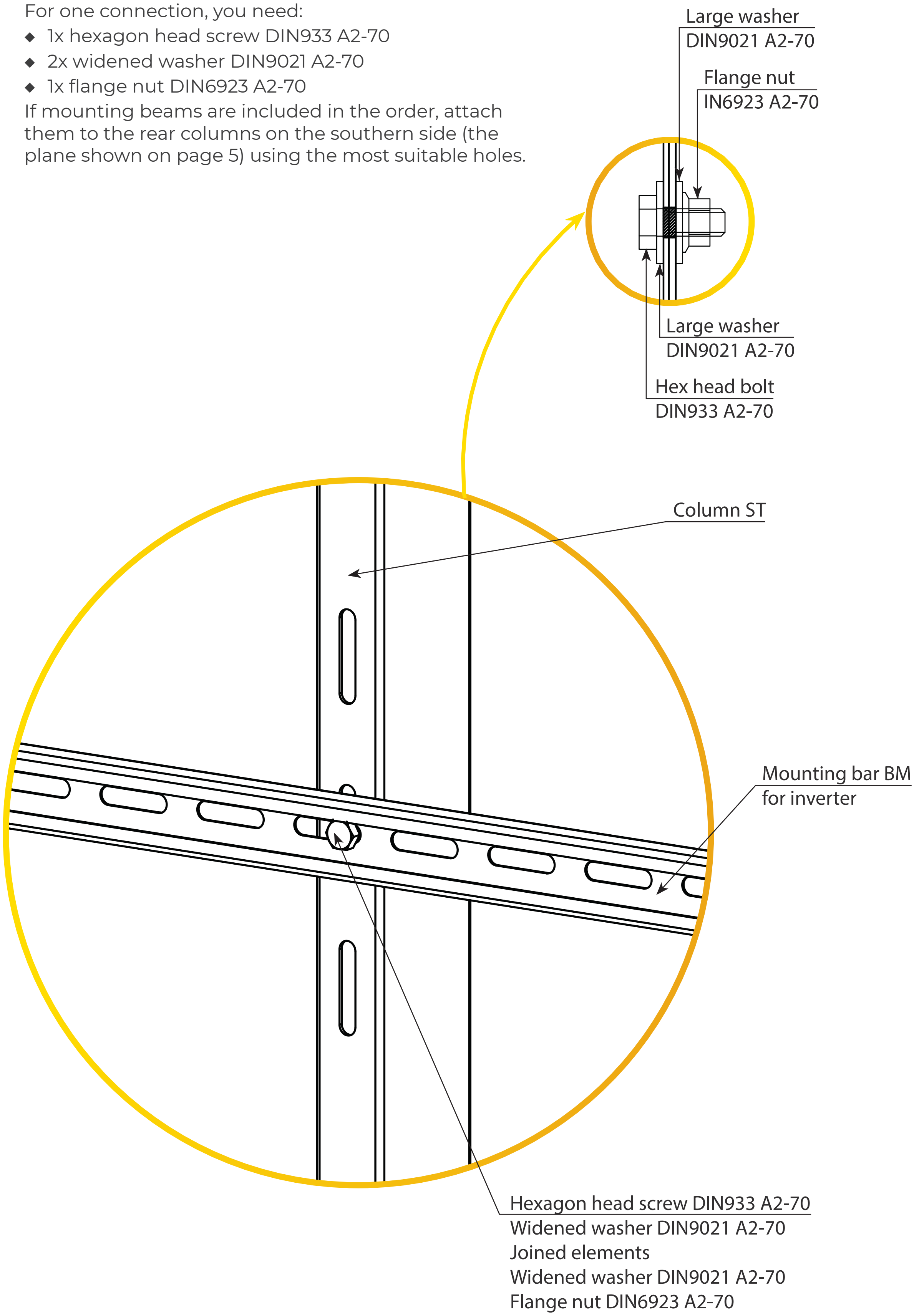
14 DETAIL OF THE CONNECTION: COLUMN ST – MOUNTING BEAM BM

D6

For one connection, you need:

- 1x hexagon head screw DIN933 A2-70
- 2x widened washer DIN9021 A2-70
- 1x flange nut DIN6923 A2-70

If mounting beams are included in the order, attach them to the rear columns on the southern side (the plane shown on page 5) using the most suitable holes.



Variant: **2P5HMMW, 2P5HMBW**

15

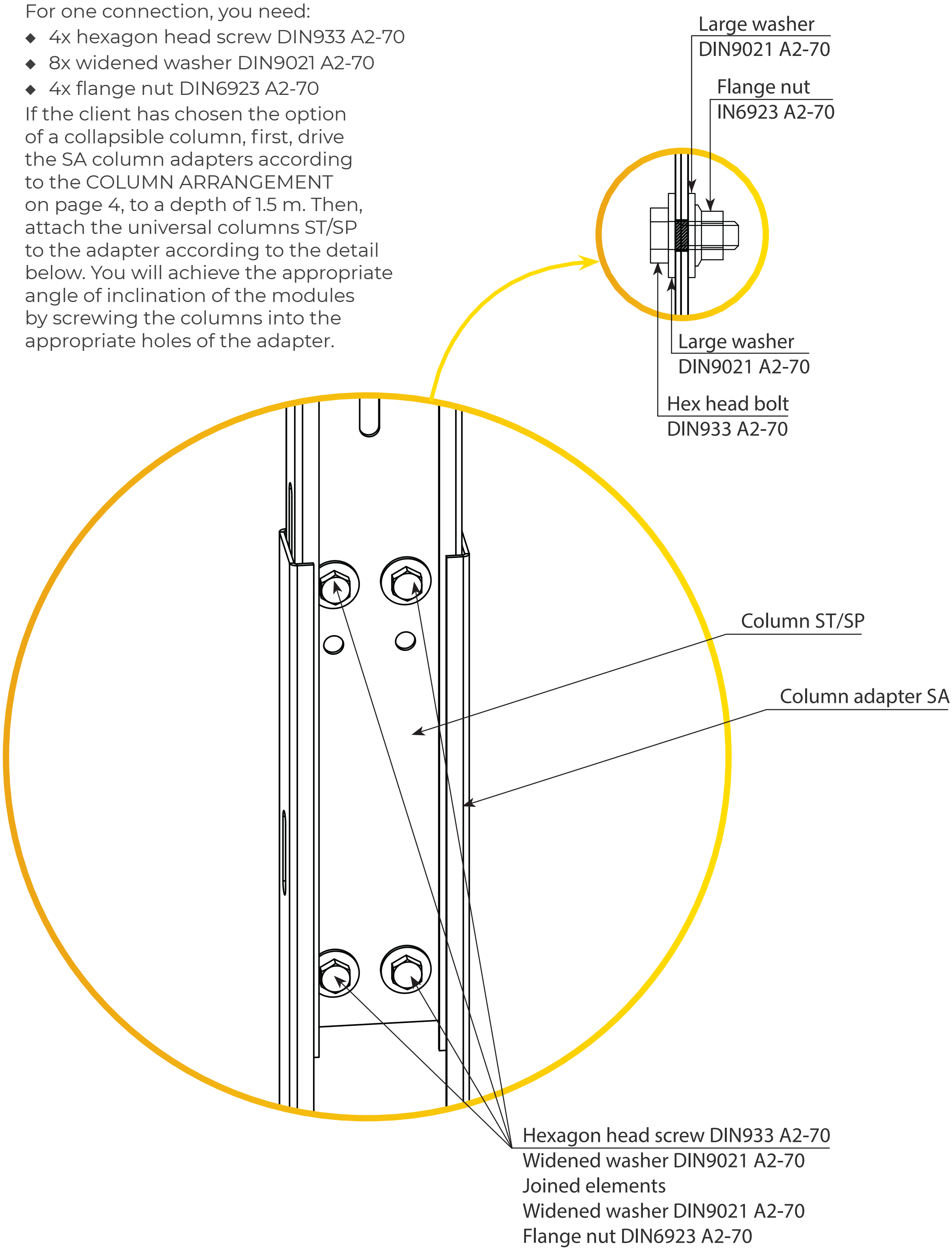
DETAIL OF THE CONNECTION: COLUMN ADAPTER SA – COLUMN SP/ST

D7

For one connection, you need:

- 4x hexagon head screw DIN933 A2-70
- 8x widened washer DIN9021 A2-70
- 4x flange nut DIN6923 A2-70

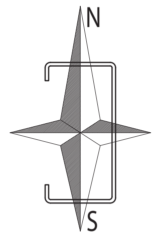
If the client has chosen the option of a collapsible column, first, drive the SA column adapters according to the COLUMN ARRANGEMENT on page 4, to a depth of 1.5 m. Then, attach the universal columns ST/SP to the adapter according to the detail below. You will achieve the appropriate angle of inclination of the modules by screwing the columns into the appropriate holes of the adapter.

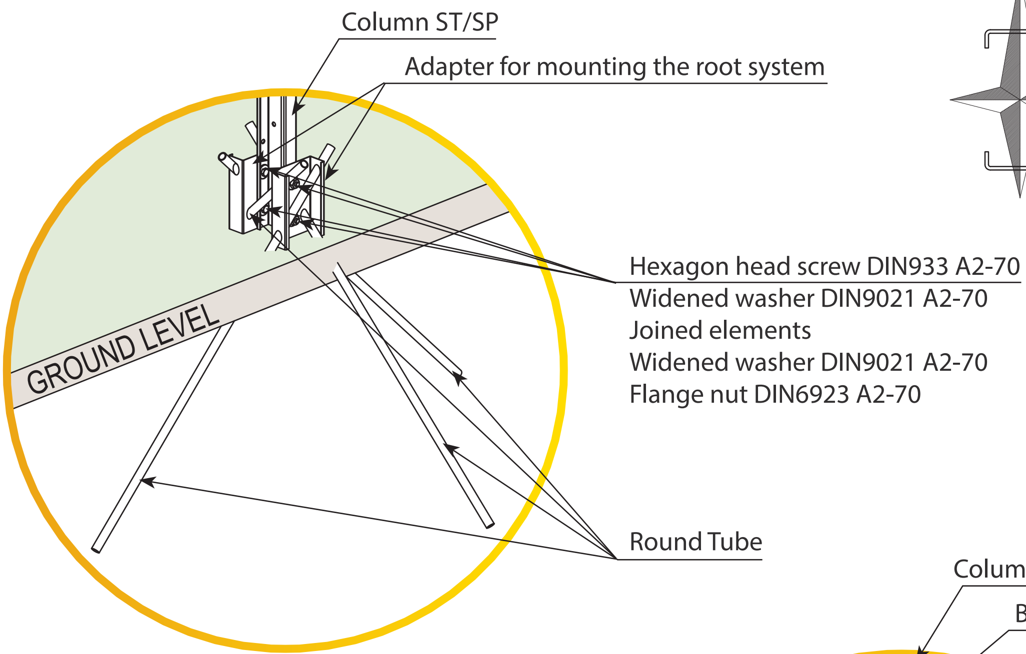


Variant: **2P5HMMW, 2P5HMBW**

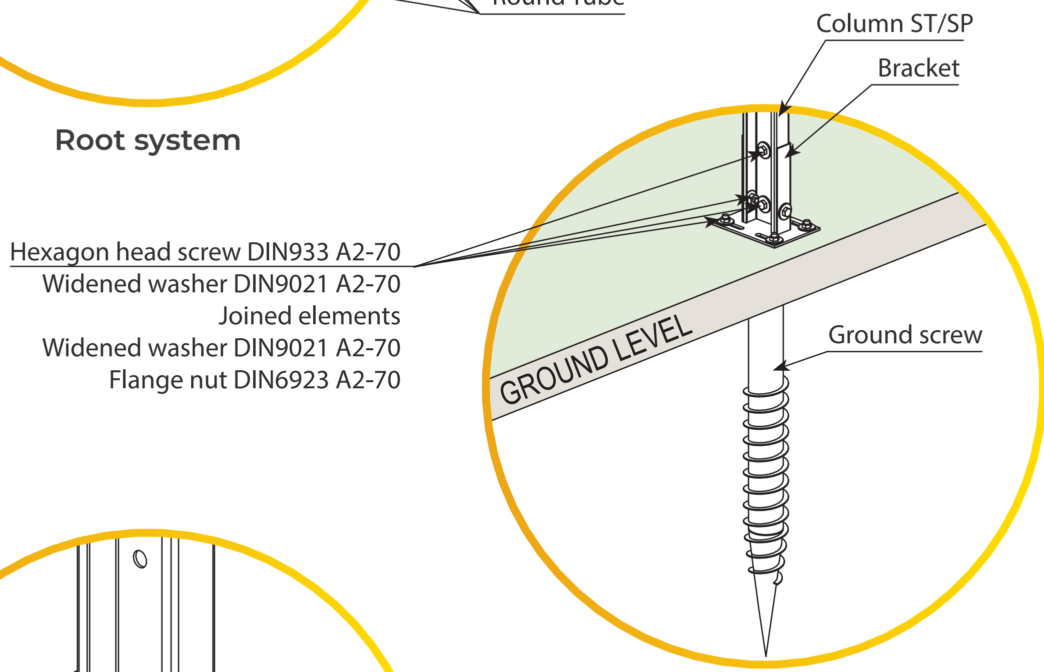
16 OPTIONAL TYPES OF FOUNDATIONS

Orientation of steel posts

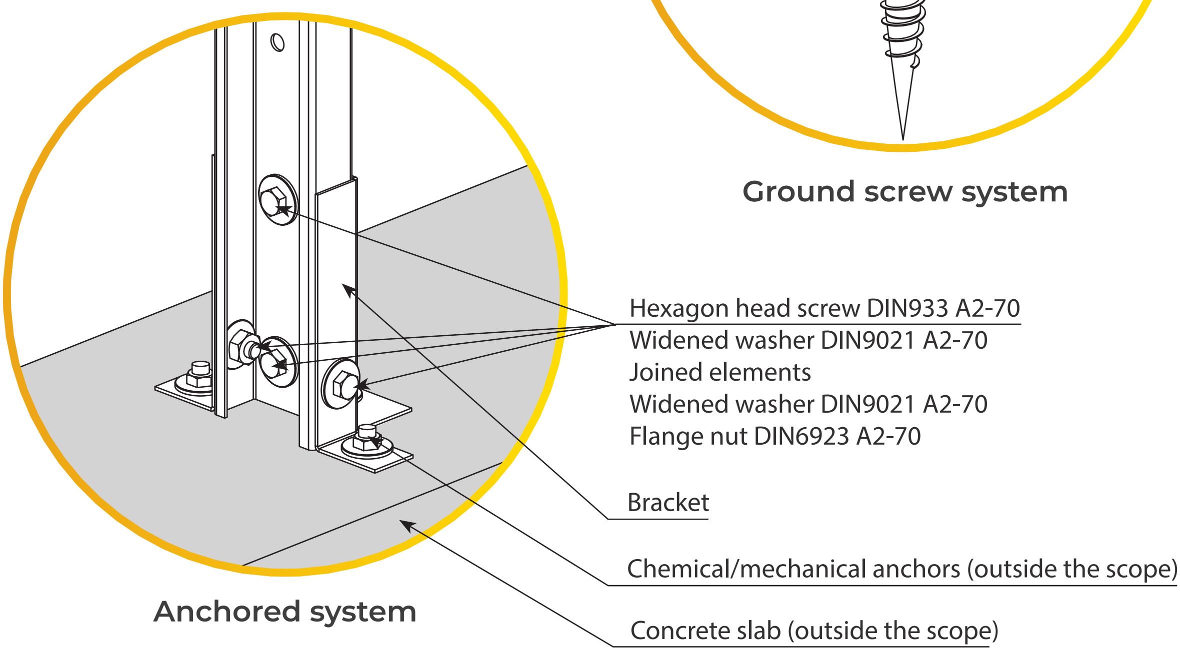




Root system



Ground screw system



Anchored system

17 GENERAL INFORMATION REGARDING THE INSTALLATION OF THE STRUCTURE

- Before installation, ensure that the substrate is stable and suitable for safely mounting the structure.
- Carry out the installation according to the instructions, without modifying the structure.
- Exercise special caution during transportation, installation, inspections, and disassembly of the structure, and keep the workspace clean.
- Please note that this manual presents only basic recommendations for the installation and operation of the selected system. It does not constitute an installation design and cannot replace one. The responsibility for choosing the appropriate mounting system and its components rests with the installers. The manufacturer of the mounting system is not responsible for the correct use or installation of these elements.
- Since the installation of the system may involve damaging the structure of elements, such as corrosion-resistant coatings or insulation of the surfaces to which it is mounted, careful planning of the installation is essential. EL-SUN is not liable for the quality or security of the connections between the system and the building or ground, nor for any damages, deterioration of functionality, or loss of warranty for these elements.
- Damaged elements of the structure must be promptly replaced, both during use and upon detecting faults during inspections.
- Inspections should be conducted according to the warranty conditions and also after any instance where wind speed exceeds the design value.
- The use of the structure is prohibited if it is not used for its intended purpose, if it is on defective or unstable ground, or if it is damaged or incomplete.