

Technical project overview

Man City Women's Facility , M11 2AP

Building project	Man City Women's Facility , M11 2AP
Date	12.09.2025
In-house project no.	PA_250912_680406
Editor	Renusol Europe GmbH
Link to configurator	Open link
Number of modules	146
Rated output	67.89 kWp

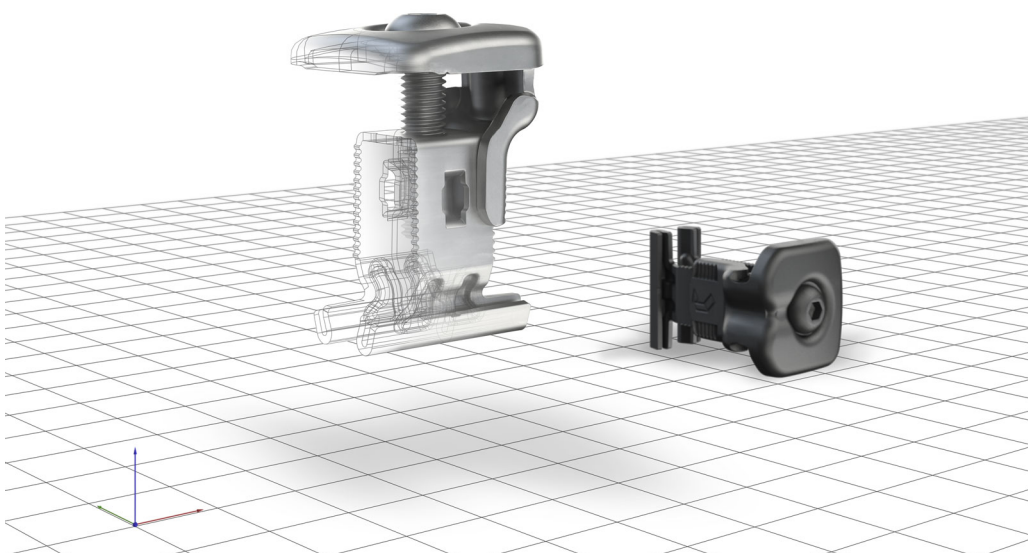


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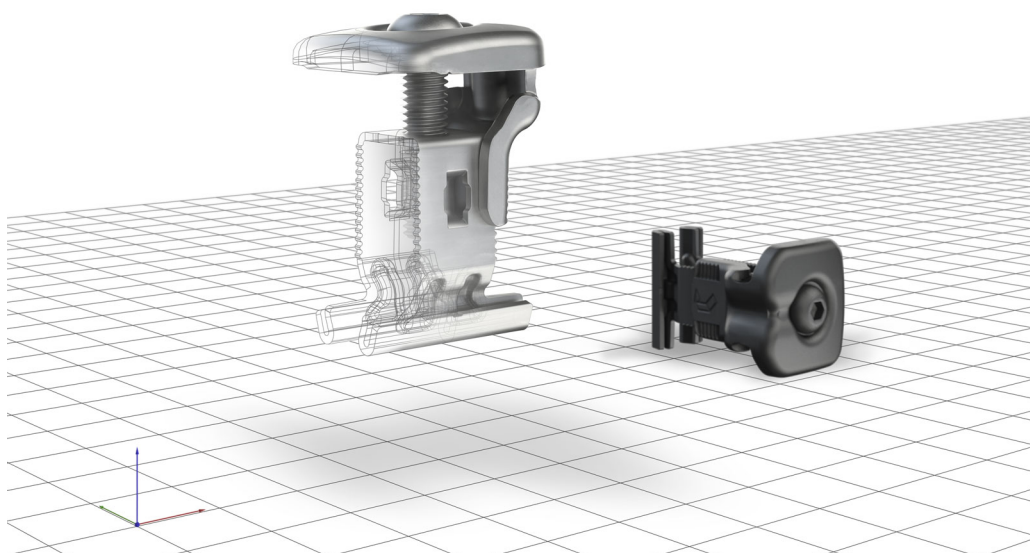
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Technical project overview

Man City Women's Facility , M11 2AP

Building project	Man City Women's Facility , M11 2AP
Address	Colliery Street 26, M11 2AP
Country	United Kingdom
Module Type	Hengdian Group DMEGC Magnetic Co. Ltd. - DM465M10RT-54HBW
Number of modules	106
Rated output	49.29 kWp
Mounting system	FSPro10EW
Editor	Renusol Europe GmbH



LOCATION

Street	Colliery Street 26
City	M11 2AP
Country	United Kingdom

SURROUNDINGS

Code	Eurocode NA GB
Terrain height above sealevel	61,00 m
Snow load zone	Zone 3
Terrain category	City
Distance to coast	50,00 km
Distance to edge of city	2,00 km
Surroundings	normal
Service life of PV system	25 years
Failure consequence class	2

LOAD CALCULATION RESULT

Peak velocity pressure	0,59 kN/m ²
Snow load	0,46 kN/m ²
Snow load on roof	0,37 kN/m ²
Base wind speed ($V_{b,0}$)	22,50 m/s

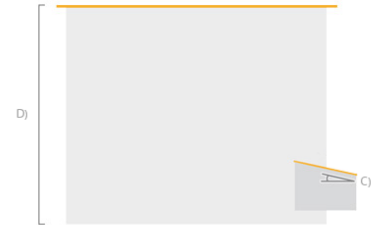
* The entered wind and snow loads are not system-verified. Please be aware that the structural analysis results are based on these unverified values.

TOPOGRAPHY

Topography	Not exposed
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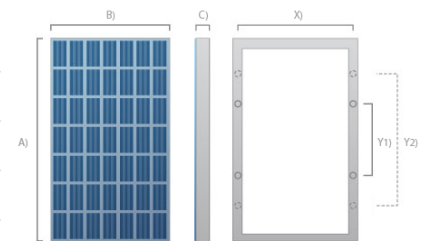
ROOF PROPERTIES

Roof type	Free-form Flat roof
Coverage type	Foil
C) Roof pitch	0,00 °
D) Building height	6,00 m
Parapet height	1500,00 mm
Parapet width	200,00 mm



MODULE PARAMETERS

Manufacturer	Hengdian Group DMEGC Magnetic Co. Ltd.
Name	DM465M10RT-54HBW
Length	1762 mm
Width	1134 mm
Height	30 mm
Weight	20.6 kg
Rated output	465 W _{peak}
Color	black

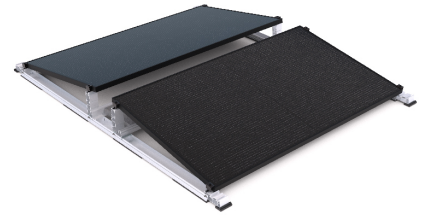


Please check the compatibility of clamping positions with module manufacturer advice.

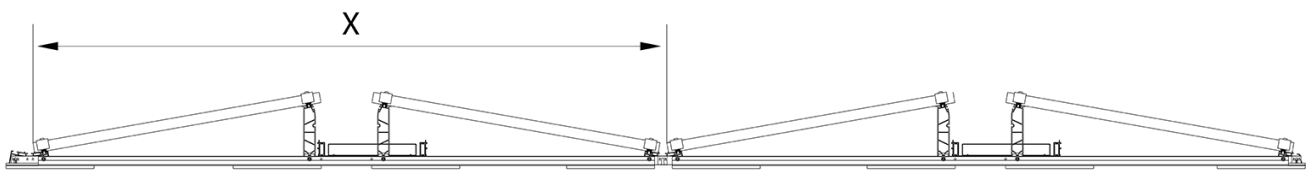
The module data was taken from a database. Please check whether this data corresponds to your actual module order. If necessary, please correct the data using the editing function.

SYSTEM

System type	Ballasted
System	FSPro10EW



Please check the entered row distance for an ideal yield calculation with a correct calculation including consideration of the shading.



FASTENER DETAILS

Mounting direction of modules	Landscape
Module clamping side	Short side
X) Row distance	2360mm
Sideplates	Never
Add third rail under the module	Automatic
Ballast block mass (optional)	10,00 kg
Friction coefficient	0,50
Partial safety factor dead load (ballast)	0.9

CLAMPS

Clamp type	Mid clamps+ / End clamps+
Clamp colour	black

STATIC VALIDATION

Your project was validated by our statics check successfully.

Maximum ballast value: 33 kg

Ballast: 1945 kg

Modules: 2184 kg

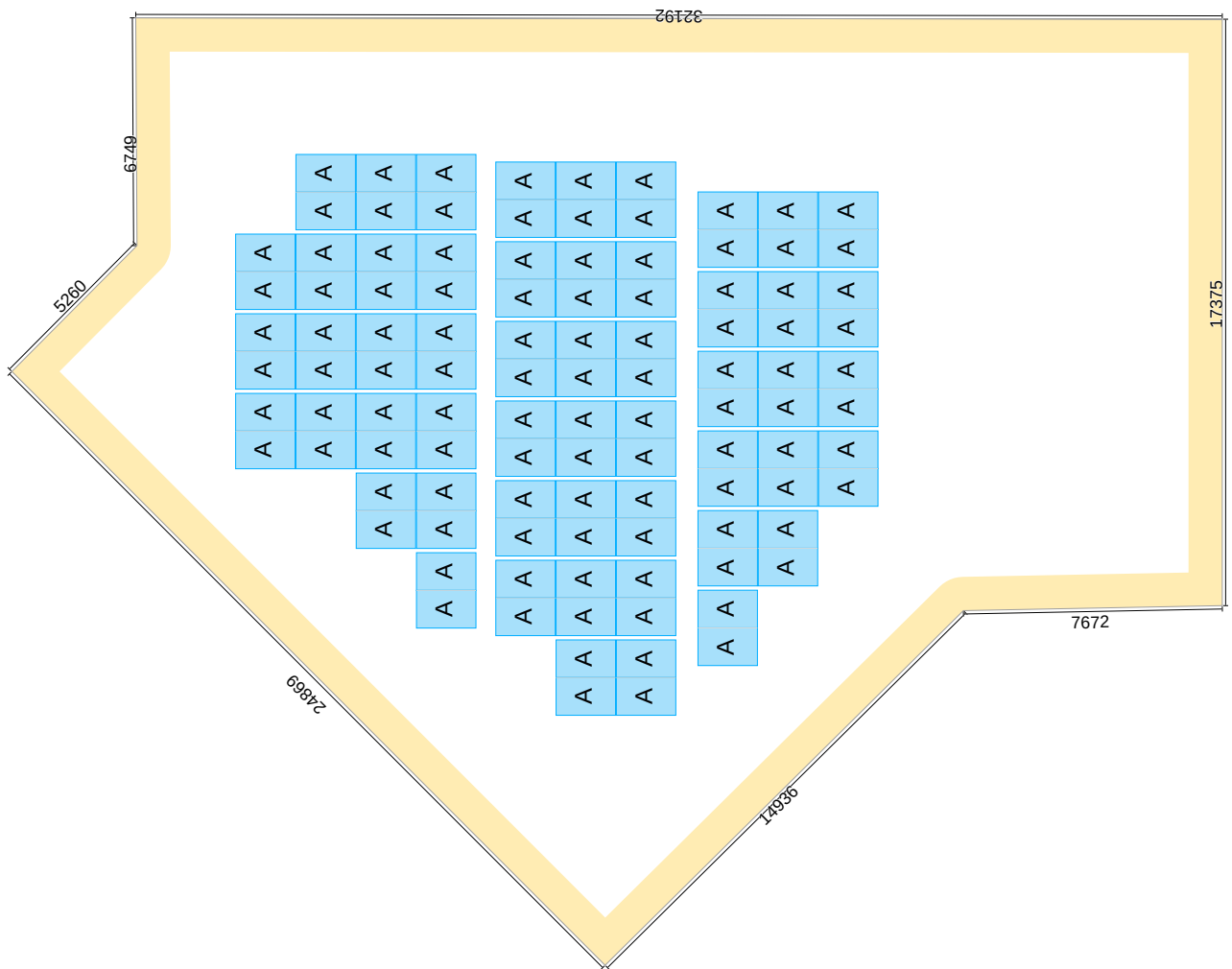
Partlist: 222 kg

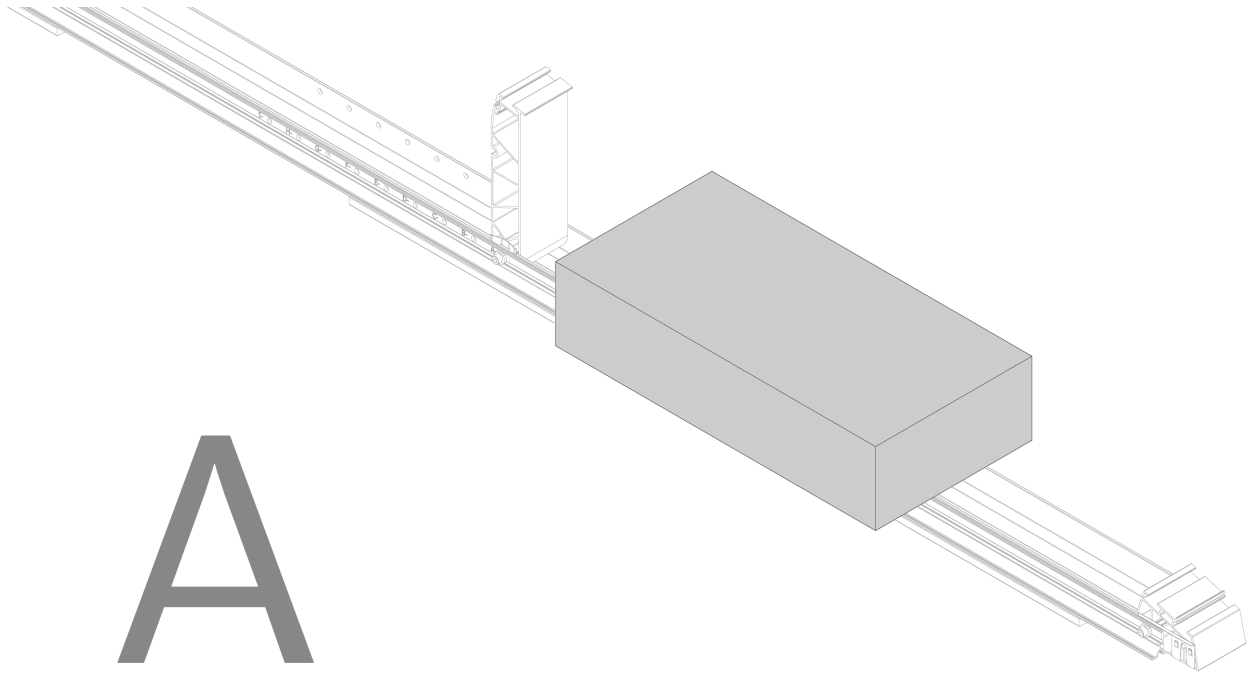
Maximum rail pressure: 7 kN/m²

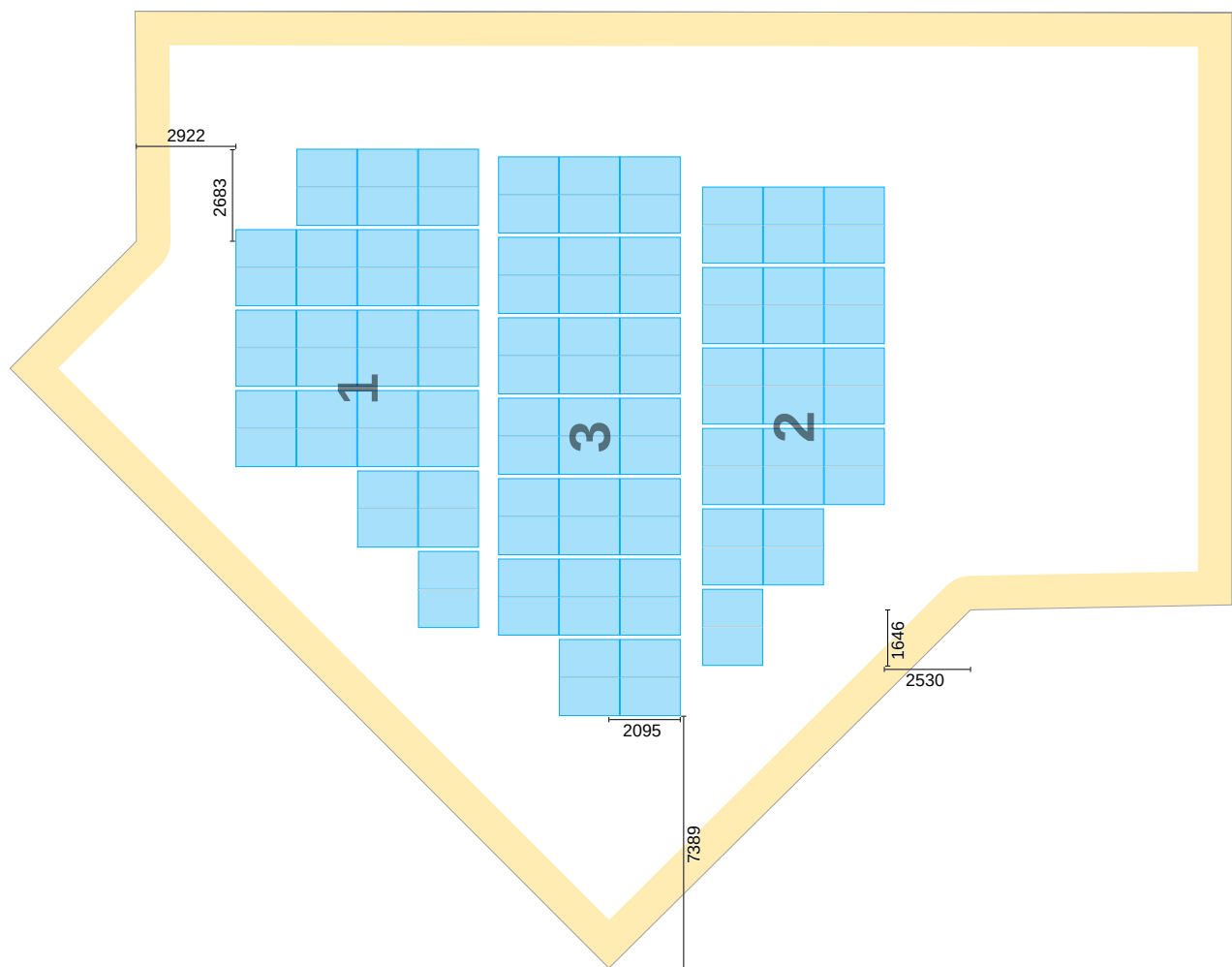
The predefined default values for input fields have to be compared with the conditions of the project. Necessary changes to adapt to local conditions must be carried out. The following relevant input fields contain their default value:

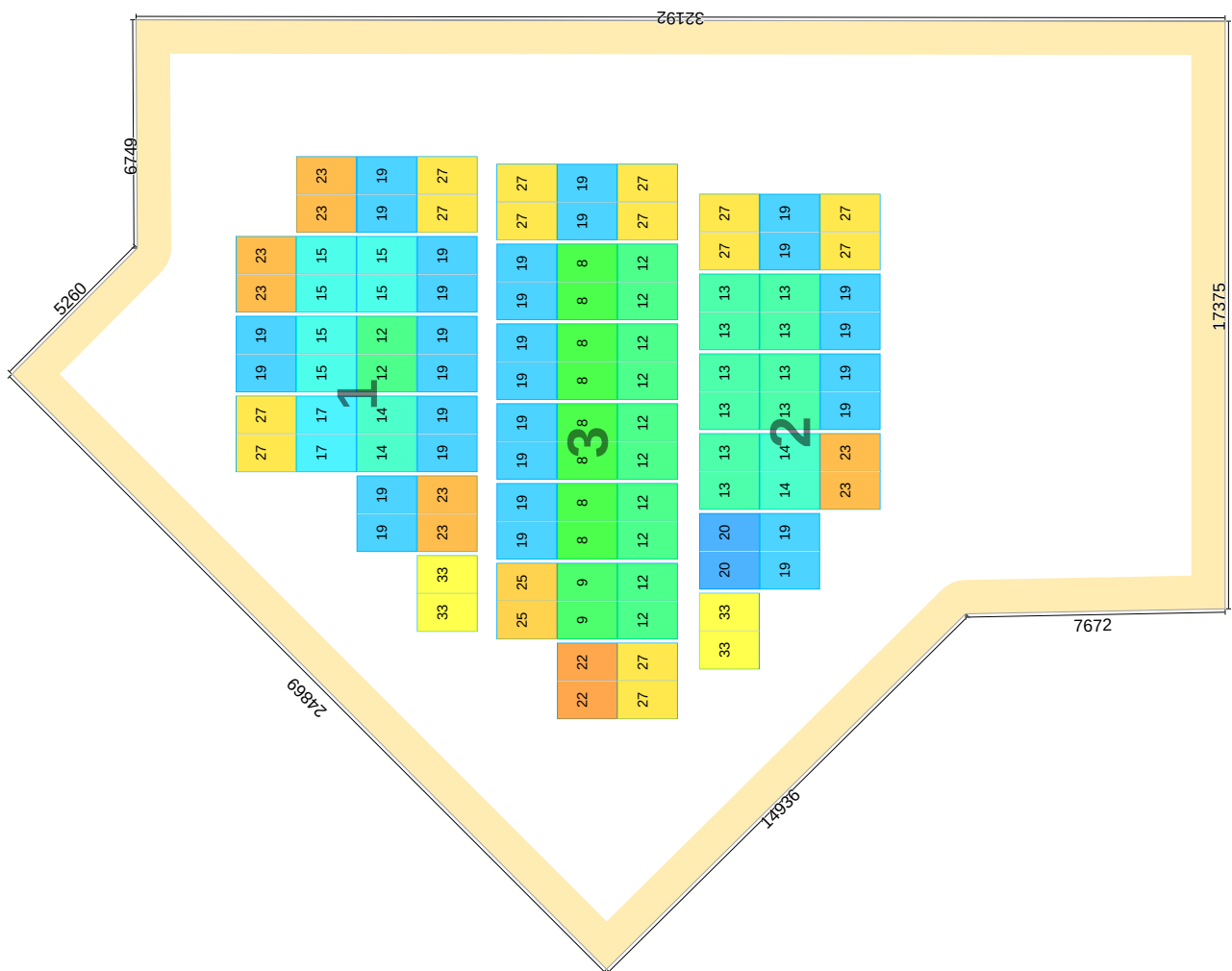
- Service life of PV system: 25 years
- Failure consequence class: 2
- Partial safety factor dead load (ballast): 0.9





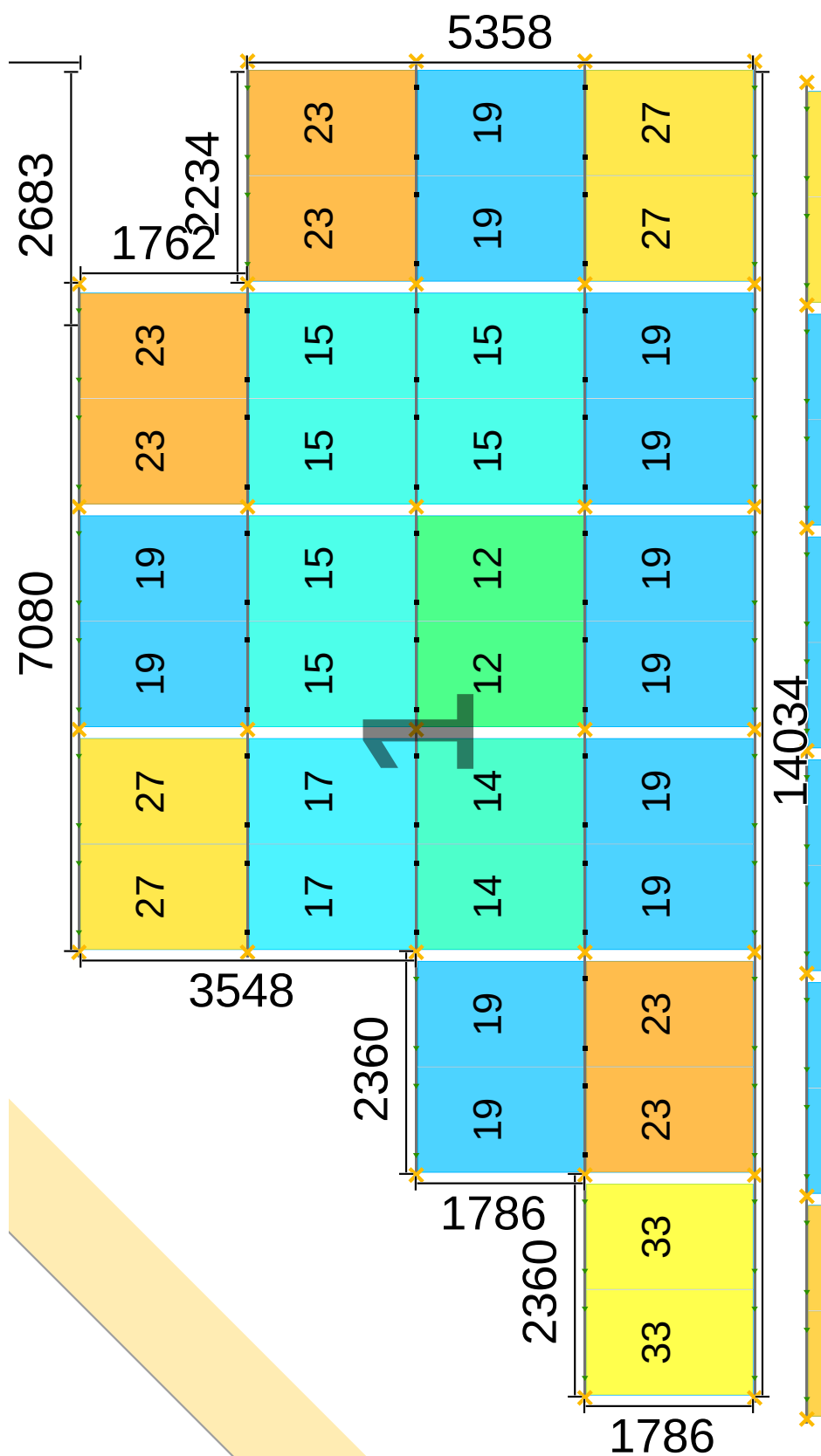


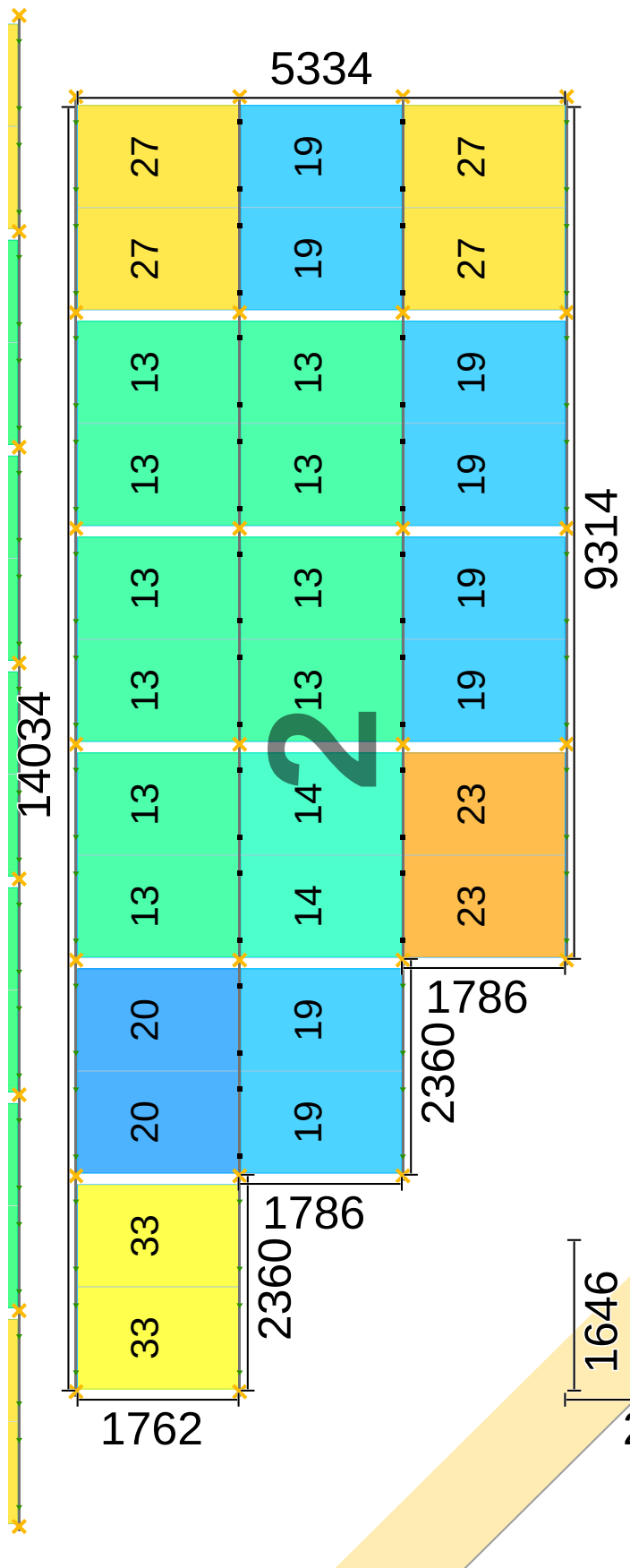


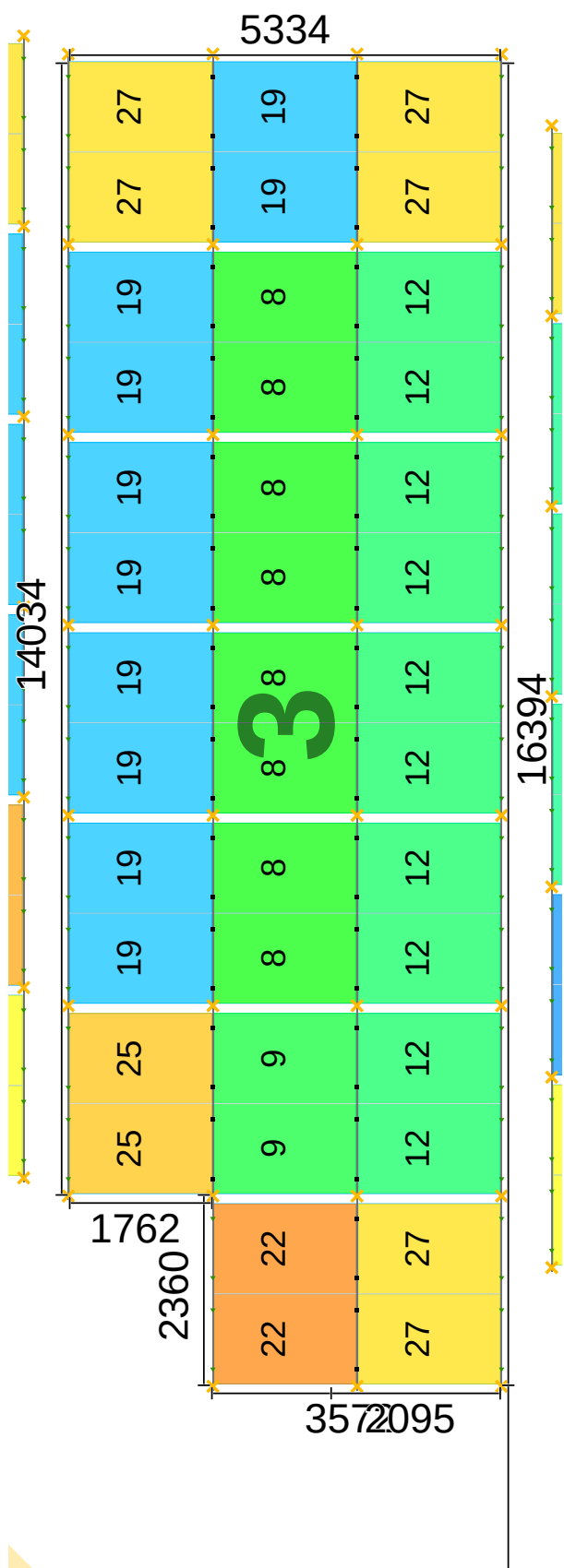


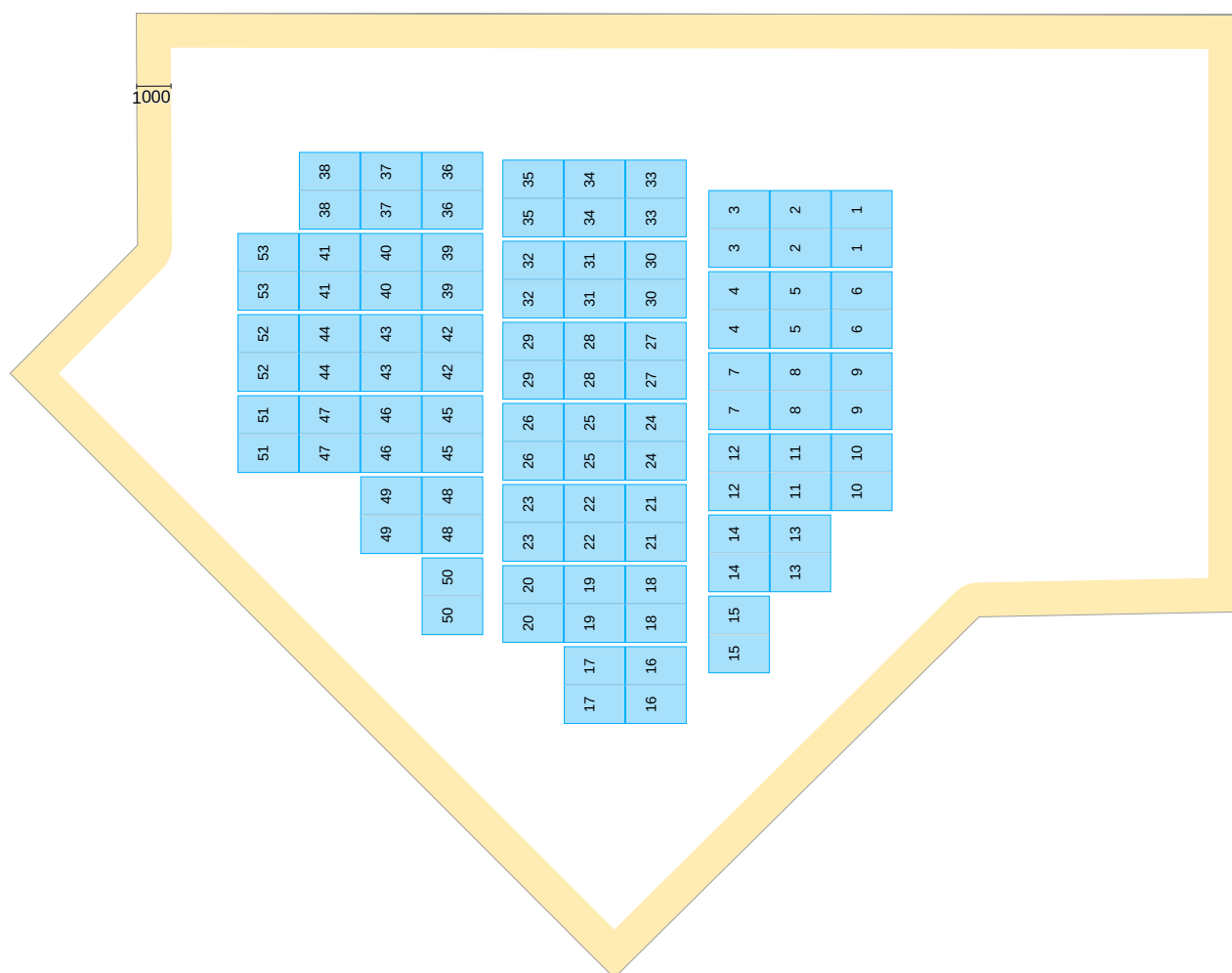
Ballast value[kg] (Blocks with 10 kg) / Sum of ballast stones: 236

8	9	12	13	14	15	17	19	20	22	23	25	27	33
(1)	(1)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(3)	(3)	(3)	(3)	(4)
(8 x 1)	(2 x 1)	(12 x 2)	(10 x 2)	(4 x 2)	(6 x 2)	(2 x 2)	(30 x 2)	(2 x 2)	(2 x 3)	(8 x 3)	(2 x 3)	(14 x 3)	(4 x 4)









BILL OF MATERIAL

Article No.	Article	Quantity	Ordering Unit	Weight/Piece	Weight
R420081-BE	End clamp+ (black)	152	1	0,064 kg	9,728 kg
R420082-BE	Middle clamp+ (black)	136	1	0,063 kg	8,568 kg
R500227	FS Pro Securing bolt	72	1	0,008 kg	0,576 kg
R500232	FS Pro 10-EW Eave support	13	1	0,196 kg	2,548 kg
R500261	FS Pro Potential equalisation clip EW	59	1	0,015 kg	0,885 kg
R500271	FS Pro Roof protection pad 110	26	1	0,006 kg	0,156 kg
R520223	FS Pro 10-EW Base rail 2300 (Set)	72	1	2,775 kg	199,800 kg
				Total Weight: 222,261 kg	

ROOF STATICS

ROOF STATICS

Total weight	4351 kg
Module weight	2184 kg
Ballast	1945 kg
Max ballast	33 kg
Roof size	682,70 m ²
Weight per total roof area	6,37 kg/m ²
Mounting system weight	222,26 kg
Max rail pressure	7 kN/m ²

MODULE FIELD STATICS

FIELD1

Total weight	1534 kg
Module weight	742 kg
Ballast	717 kg
Max ballast	33 kg
Field area	75,02 m ²
Weight per field area	20,45 kg/m ²
Mounting system weight	75,48 kg
Max rail pressure	7 kN/m ²

FIELD2

Total weight	1255 kg
Module weight	618 kg
Ballast	575 kg
Max ballast	33 kg
Field area	62,21 m ²
Weight per field area	20,18 kg/m ²
Mounting system weight	62,90 kg
Max rail pressure	7 kN/m ²

FIELD3

Total weight	1561 kg
Module weight	824 kg
Ballast	653 kg
Max ballast	27 kg
Field area	83,29 m ²
Weight per field area	18,75 kg/m ²
Mounting system weight	83,87 kg
Max rail pressure	7 kN/m ²

LOAD ASSUMPTIONS

Dead load

Solar modules type DM465M10RT-54HBW are used.

Dimensions: 1762 mm x 1134 mm

Weight: G = 20.6 kg

Snow load

The determination of the snow load is carried out according to BS EN 1991-1-3:2003/NA:2010-06.

Snow-trap formation or snow-load accumulations are not considered in the calculation. Please contact Renusol if necessary.

Height above sea level: 61 m

Snow load zone: 3

Roof pitch: $\alpha = 0^\circ$

Module elevation: $\beta = 10^\circ$

total pitch: 10.0°

Period of use: 25 Year

Snow load: $s_k = s_{k,50} * f_s = 0.50 \text{ kN/m}^2 * 0.93 = 0.46 \text{ kN/m}^2$

$\mu_{t1} = 0.800$

$s_1 = \mu_{t1} * s_k = 0.8 * 0.46 \text{ kN/m}^2 = 0.371 \text{ kN/m}^2$

$s_{1,10^\circ} = 0.371 \text{ kN/m}^2 * \cos(10.0^\circ) = 0.371 \text{ kN/m}^2$

Wind load

The determination of the wind load is carried out according to BS EN 1991-1-4:2005/NA:2011-01.

Building height roof ridge: 6 m

Terrain category: Town terrain

Basic wind velocity: 22.50 m/s

Distance to shoreline: 50.000 km

Distance inside town terrain: 2.000 km

Period of use: 25 Year

Pressure of the gusts velocity: $q(z) = 0.592 \text{ kN/m}^2$

STATIC CALCULATION

Parameters

$\gamma_G = 0.9$	Partial safety factor self-weight
$\gamma_Q = 1.5$	Partial safety factor wind
$A_M = 2.00 \text{ m}^2$	Module surface area
$\beta_M = 10.0^\circ$	Module elevation
$m = 45.2 \text{ kg}$	Masse eines Modultisches (2 Module incl. Unterkonstruktion)
$\alpha = 0^\circ$	Roof pitch
$\mu = 0.5$	Friction coefficient
$q_p = 0.592 \text{ kN/m}^2$	Pressure of the gusts velocity
$g = 9.81 \text{ m/s}^2$	Gravity

Coefficients and factors

n	Number of double-panels taken into account as connected
$80 \text{ m}^2 \leq A_{\text{eff}} = 2 * n * A_M \leq 930 \text{ m}^2$	Effectiv modul area
$k_A = 1 - 0.49 * \lg(A_{\text{eff}}/80\text{m}^2) / \lg(930/80)$	Coefficient of effective module surface
$k_R = 1.6$	Coefficient for modules close to the edge of the roof
k_p	Coefficient for parapet height
$k_\alpha = \mu / (\mu * \cos(\alpha) - \sin(\alpha)) = 1.00$	Coefficient for the inclination of the roof in case of sliding
$cp_1^A, cp_2^A, cp_1^B, cp_2^B$	Pressure coefficients for panel A and panel B (east-west)

Total pressure coefficients

$$c_1^A = cp_1^A * k_p * k_A * k_R$$

$$c_2^A = cp_2^A * k_p * k_A * k_R$$

$$c_1^B = cp_1^B * k_p * k_A * k_R$$

$$c_2^B = cp_2^B * k_p * k_A * k_R$$

Acting forces

$$F_z^A = -q_p * A_M * \cos(\beta_M) * (c_1^A + c_2^A)$$

$$F_x^A = q_p * A_M * \sin(\beta_M) * |c_1^A - c_2^A|$$

$$F_z^B = -q_p * A_M * \cos(\beta_M) * (c_1^B + c_2^B)$$

$$F_x^B = q_p * A_M * \sin(\beta_M) * |c_1^B - c_2^B|$$

Vertical load - System A
Horizontal load - System A
Vertical load - System B
Horizontal load - System B

Ballast for a double panel

$$G_W^A = k_\alpha * \gamma_Q * (F_x^A / \mu + F_z^A) / \gamma_G$$

$$G_W^B = k_\alpha * \gamma_Q * (F_x^B / \mu + F_z^B) / \gamma_G$$

$$G_W = 0.40 * G_W^A + 0.60 * G_W^B$$

$$G_A^A = \cos^{-1}(\alpha) * \gamma_Q * F_z^A / \gamma_G$$

$$G_A^B = \cos^{-1}(\alpha) * \gamma_Q * F_z^B / \gamma_G$$

$$G_A = 0.40 * G_A^A + 0.60 * G_A^B$$

$$B = \text{MAX}(G_W, G_A) / g - m$$

Overall calculated force in case of sliding - System A
Overall calculated force in case of sliding - System B
Overall calculated force in case of sliding
Ballast required - System A
Ballast required - System B
Ballast required
Required ballast

STATIC CALCULATION

Module	Ballast [kg]	Load case	k_R	n	k_p	cp_1^A	cp_2^A	cp_1^B	cp_2^B
1	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005
2	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
3	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005
4	26.1	Sliding	1.0	15	1.144	-0.174	0.091	-0.337	0.075
5	26.1	Sliding	1.0	15	1.144	-0.174	0.091	-0.337	0.075
6	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
7	26.1	Sliding	1.0	15	1.144	-0.174	0.091	-0.337	0.075
8	26.1	Sliding	1.0	15	1.144	-0.174	0.091	-0.337	0.075
9	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
10	45.3	Lifting	1.0	5	1.500	-0.147	-0.046	-0.340	-0.039
11	28.8	Lifting	1.0	8	1.500	-0.130	-0.040	-0.273	-0.029
12	26.1	Sliding	1.0	15	1.144	-0.174	0.091	-0.337	0.075
13	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
14	40.7	Lifting	1.0	5	1.310	-0.265	0.045	-0.379	-0.026
15	66.0	Lifting	1.0	3	1.170	-0.179	-0.076	-0.630	-0.001
16	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005
17	44.7	Lifting	1.0	5	1.170	-0.145	-0.064	-0.516	0.009
18	24.8	Lifting	1.0	6	1.170	-0.121	-0.059	-0.365	-0.019
19	18.3	Lifting	1.0	8	1.170	-0.107	-0.052	-0.342	-0.008
20	49.2	Lifting	1.0	5	1.500	-0.162	-0.068	-0.271	-0.106
21	24.8	Lifting	1.0	6	1.170	-0.121	-0.059	-0.365	-0.019
22	15.6	Lifting	1.0	9	1.170	-0.102	-0.050	-0.333	-0.003
23	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
24	24.8	Lifting	1.0	6	1.170	-0.121	-0.059	-0.365	-0.019
25	15.6	Lifting	1.0	9	1.170	-0.102	-0.050	-0.333	-0.003
26	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
27	24.8	Lifting	1.0	6	1.170	-0.121	-0.059	-0.365	-0.019
28	15.6	Lifting	1.0	9	1.170	-0.102	-0.050	-0.333	-0.003
29	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
30	24.8	Lifting	1.0	6	1.170	-0.121	-0.059	-0.365	-0.019
31	15.6	Lifting	1.0	9	1.170	-0.102	-0.050	-0.333	-0.003
32	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
33	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005
34	37.1	Lifting	1.0	6	1.170	-0.134	-0.060	-0.476	0.012
35	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005

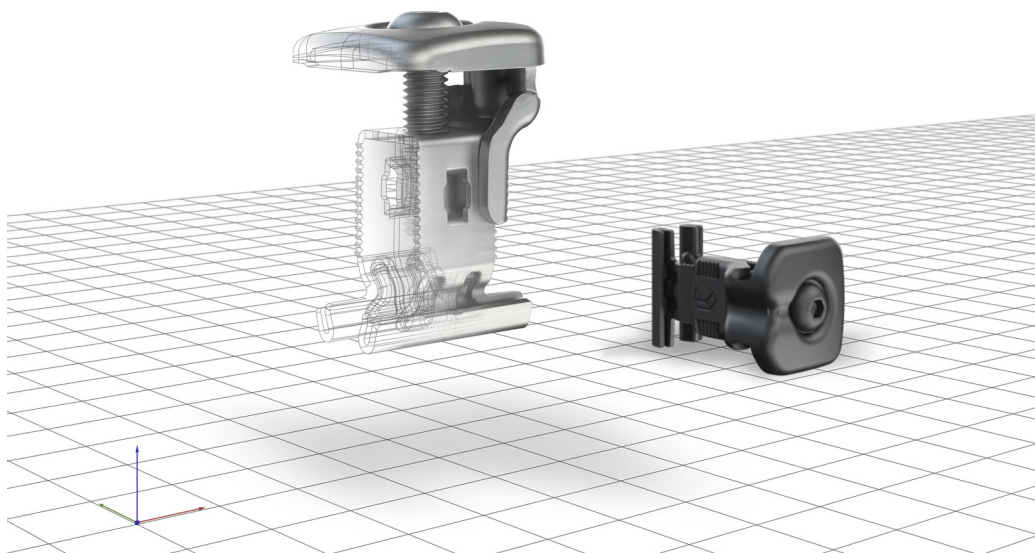
STATIC CALCULATION

Module	Ballast [kg]	Load case	k_R	n	k_p	cp_1^A	cp_2^A	cp_1^B	cp_2^B
36	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005
37	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
38	45.3	Lifting	1.0	5	1.500	-0.147	-0.046	-0.340	-0.039
39	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
40	29.0	Sliding	1.0	18	1.130	-0.233	0.092	-0.322	0.081
41	29.0	Sliding	1.0	18	1.130	-0.233	0.092	-0.322	0.081
42	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
43	24.7	Lifting	1.0	9	1.500	-0.123	-0.039	-0.255	-0.030
44	29.0	Sliding	1.0	18	1.130	-0.233	0.092	-0.322	0.081
45	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
46	28.8	Lifting	1.0	8	1.500	-0.130	-0.040	-0.273	-0.029
47	33.4	Lifting	1.0	7	1.500	-0.135	-0.042	-0.292	-0.031
48	45.3	Lifting	1.0	5	1.500	-0.147	-0.046	-0.340	-0.039
49	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
50	66.0	Lifting	1.0	3	1.170	-0.179	-0.076	-0.630	-0.001
51	54.0	Lifting	1.0	4	1.170	-0.160	-0.069	-0.566	0.005
52	38.8	Lifting	1.0	6	1.500	-0.140	-0.044	-0.314	-0.035
53	45.3	Lifting	1.0	5	1.500	-0.147	-0.046	-0.340	-0.039

Technical project overview

Man City Women's Facility , M11 2AP

Building project	Man City Women's Facility , M11 2AP
Address	Colliery Street 26, M11 2AP
Country	United Kingdom
Module Type	Hengdian Group DMEGC Magnetic Co. Ltd. - DM465M10RT-54HBW
Number of modules	40
Rated output	18.6 kWp
Mounting system	FSPro10EW
Editor	Renusol Europe GmbH



LOCATION

Street	Colliery Street 26
City	M11 2AP
Country	United Kingdom

SURROUNDINGS

Code	Eurocode NA GB
Terrain height above sealevel	61,00 m
Snow load zone	Zone 3
Terrain category	City
Distance to coast	50,00 km
Distance to edge of city	2,00 km
Surroundings	normal
Service life of PV system	25 years
Failure consequence class	2

LOAD CALCULATION RESULT

Peak velocity pressure	0,59 kN/m ²
Snow load	0,46 kN/m ²
Snow load on roof	0,37 kN/m ²
Base wind speed ($V_{b,0}$)	22,50 m/s

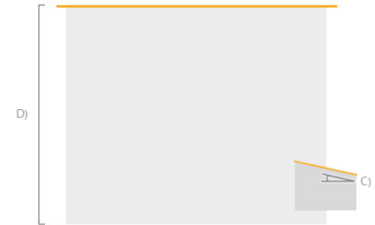
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TOPOGRAPHY

Topography	Not exposed
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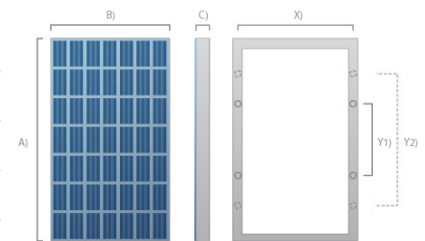
ROOF PROPERTIES

Roof type	Free-form Flat roof
Coverage type	Foil
C) Roof pitch	0,00 °
D) Building height	6,00 m
Parapet height	1500,00 mm
Parapet width	200,00 mm



MODULE PARAMETERS

Manufacturer	Hengdian Group DMEGC Magnetic Co. Ltd.
Name	DM465M10RT-54HBW
Length	1762 mm
Width	1134 mm
Height	30 mm
Weight	20.6 kg
Rated output	465 W _{peak}
Color	black

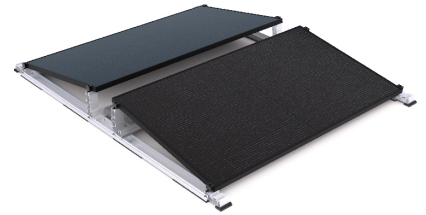


Please check the compatibility of clamping positions with module manufacturer advice.

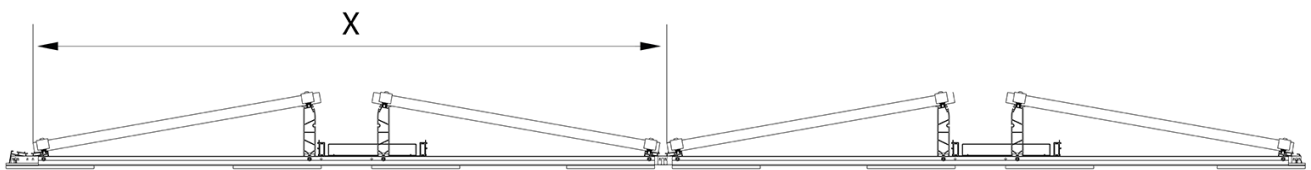
The module data was taken from a database. Please check whether this data corresponds to your actual module order. If necessary, please correct the data using the editing function.

SYSTEM

System type	Ballasted
System	FSPro10EW



Please check the entered row distance for an ideal yield calculation with a correct calculation including consideration of the shading.



FASTENER DETAILS

Mounting direction of modules	Landscape
Module clamping side	Short side
X) Row distance	2360mm
Sideplates	Never
Add third rail under the module	Automatic
Ballast block mass (optional)	10,00 kg
Friction coefficient	0,50
Partial safety factor dead load (ballast)	0.9

CLAMPS

Clamp type	Mid clamps+ / End clamps+
Clamp colour	black

STATIC VALIDATION

Your project was validated by our statics check successfully.

Maximum ballast value: 25 kg

Ballast: 560 kg

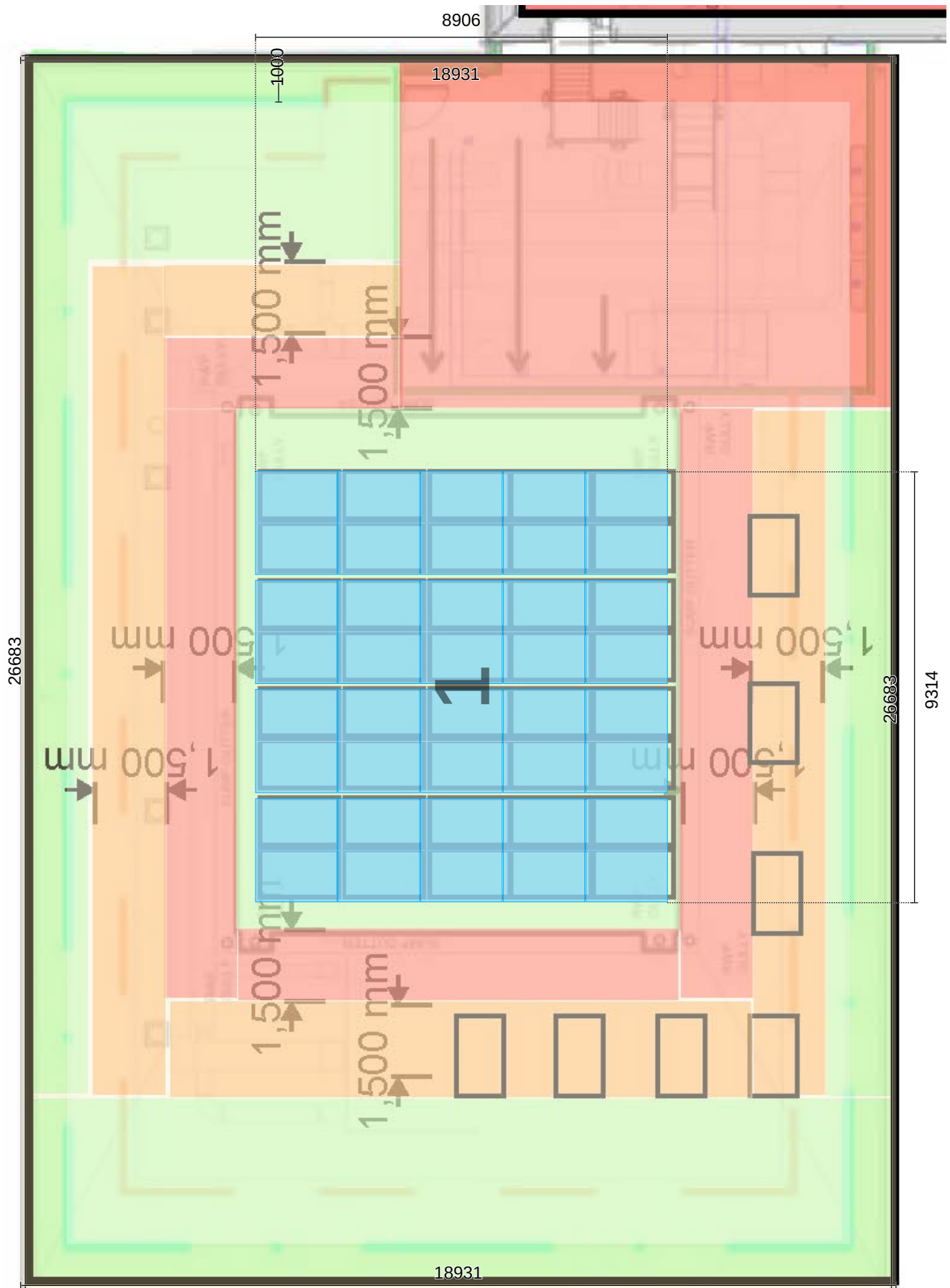
Modules: 824 kg

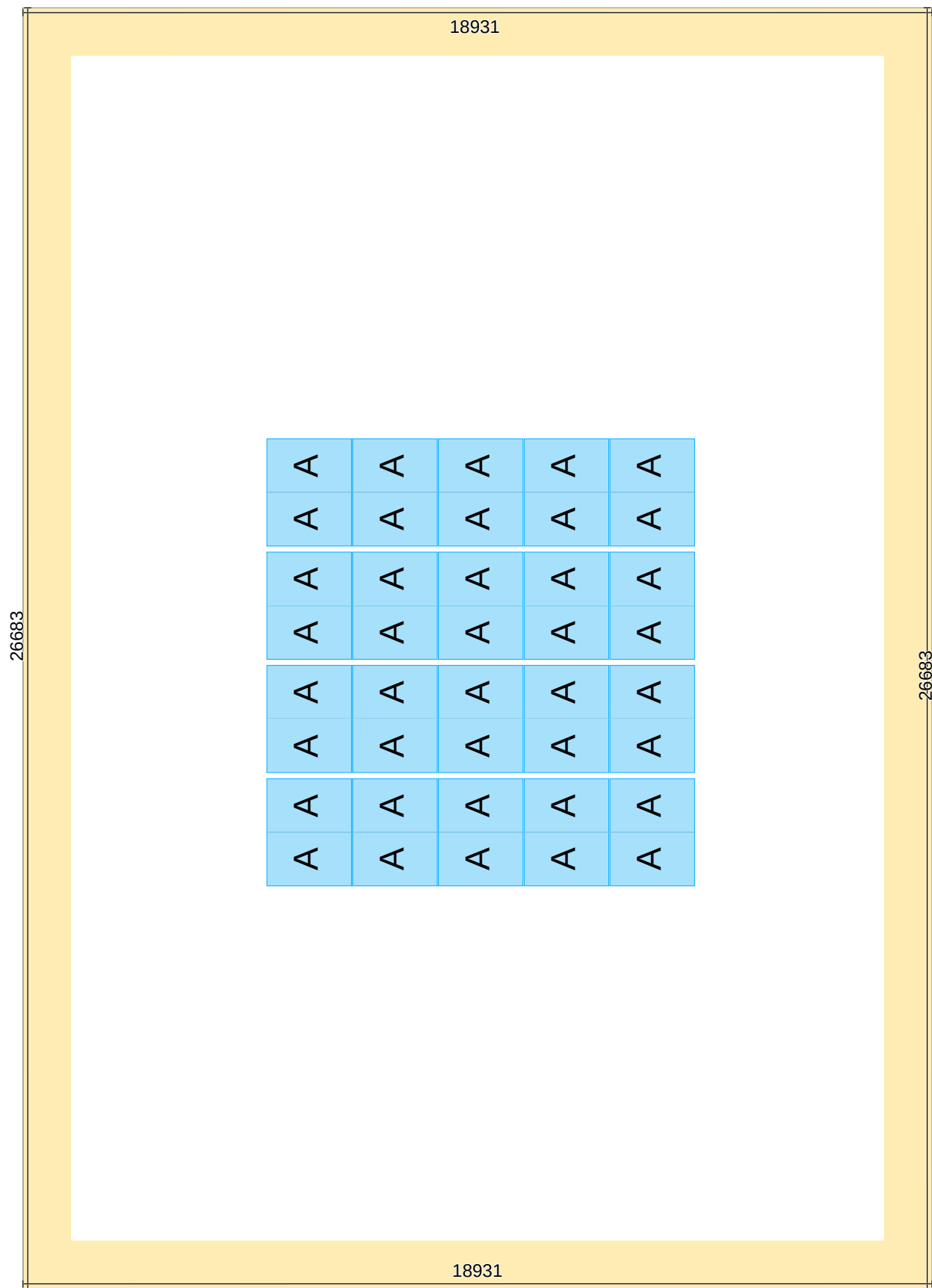
Partlist: 74 kg

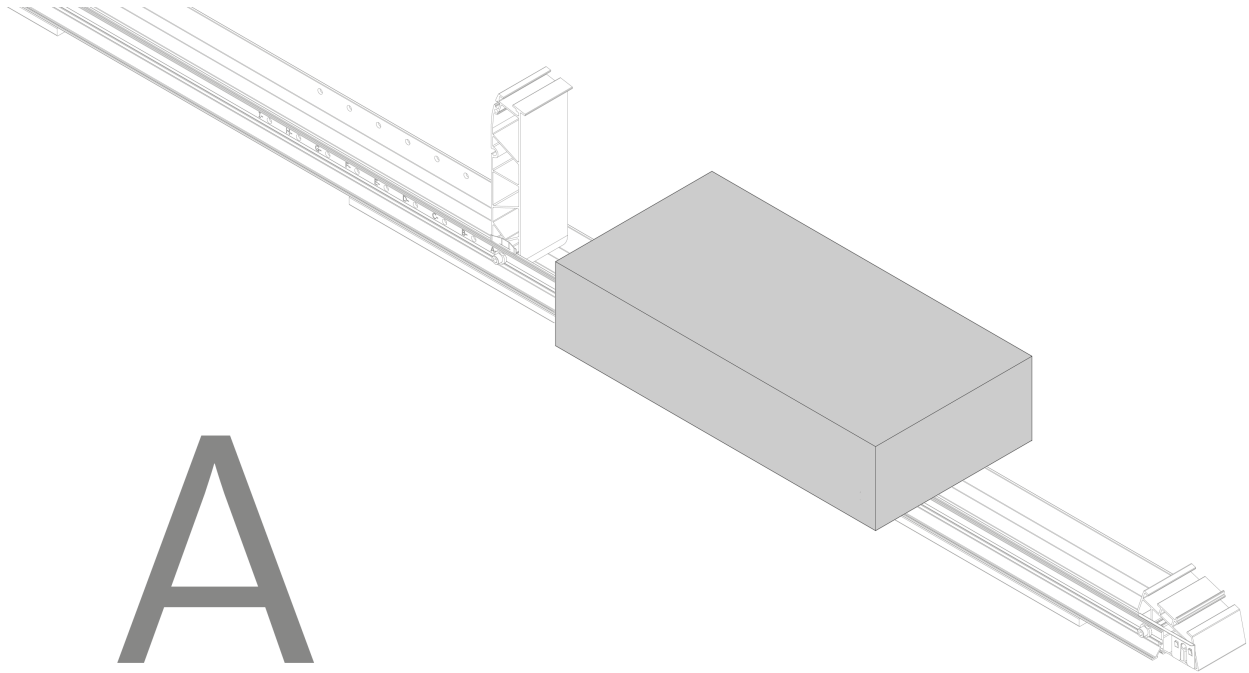
Maximum rail pressure: 6 kN/m²

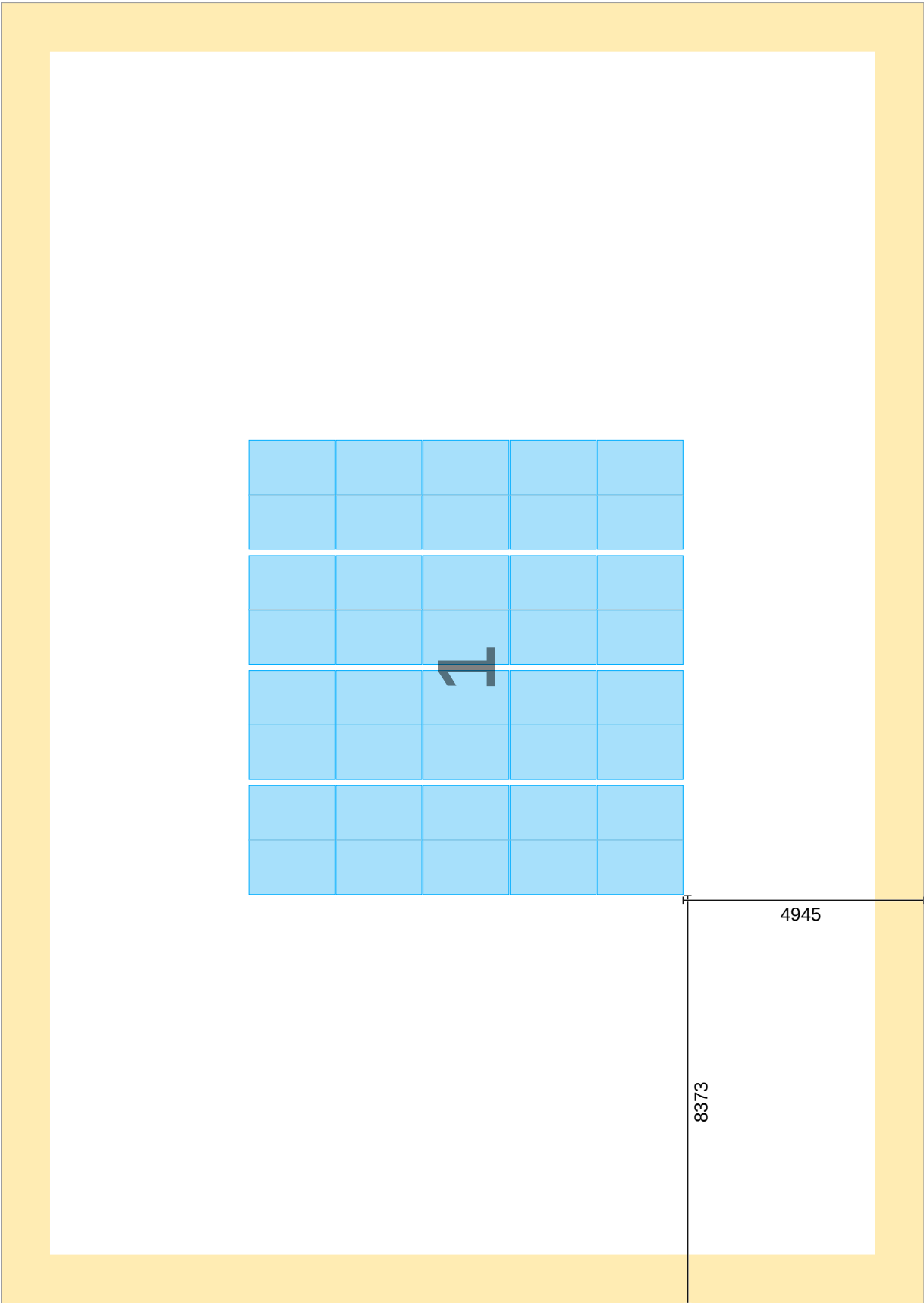
The predefined default values for input fields have to be compared with the conditions of the project. Necessary changes to adapt to local conditions must be carried out. The following relevant input fields contain their default value:

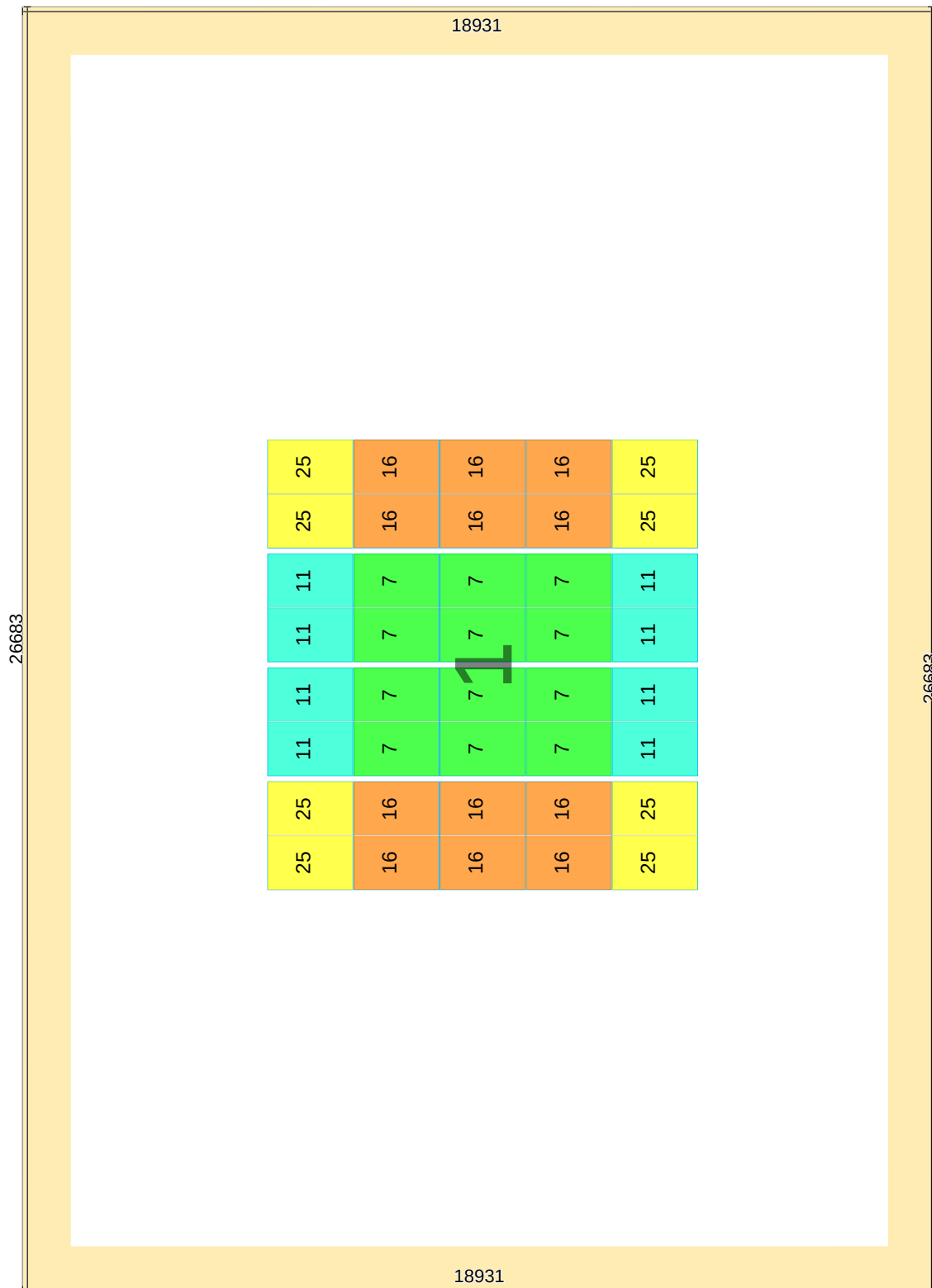
- Service life of PV system: 25 years
- Failure consequence class: 2
- Partial safety factor dead load (ballast): 0.9





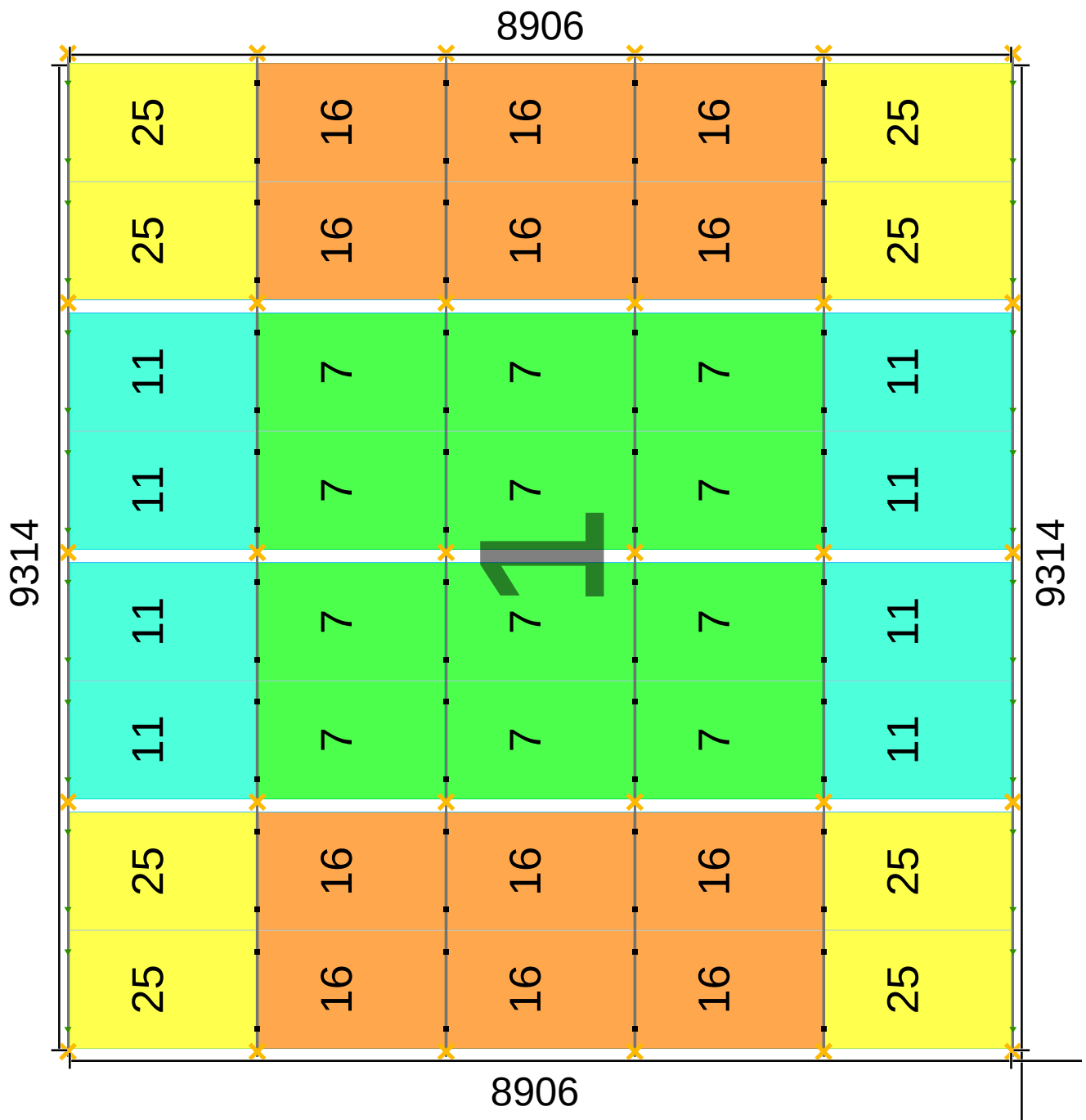


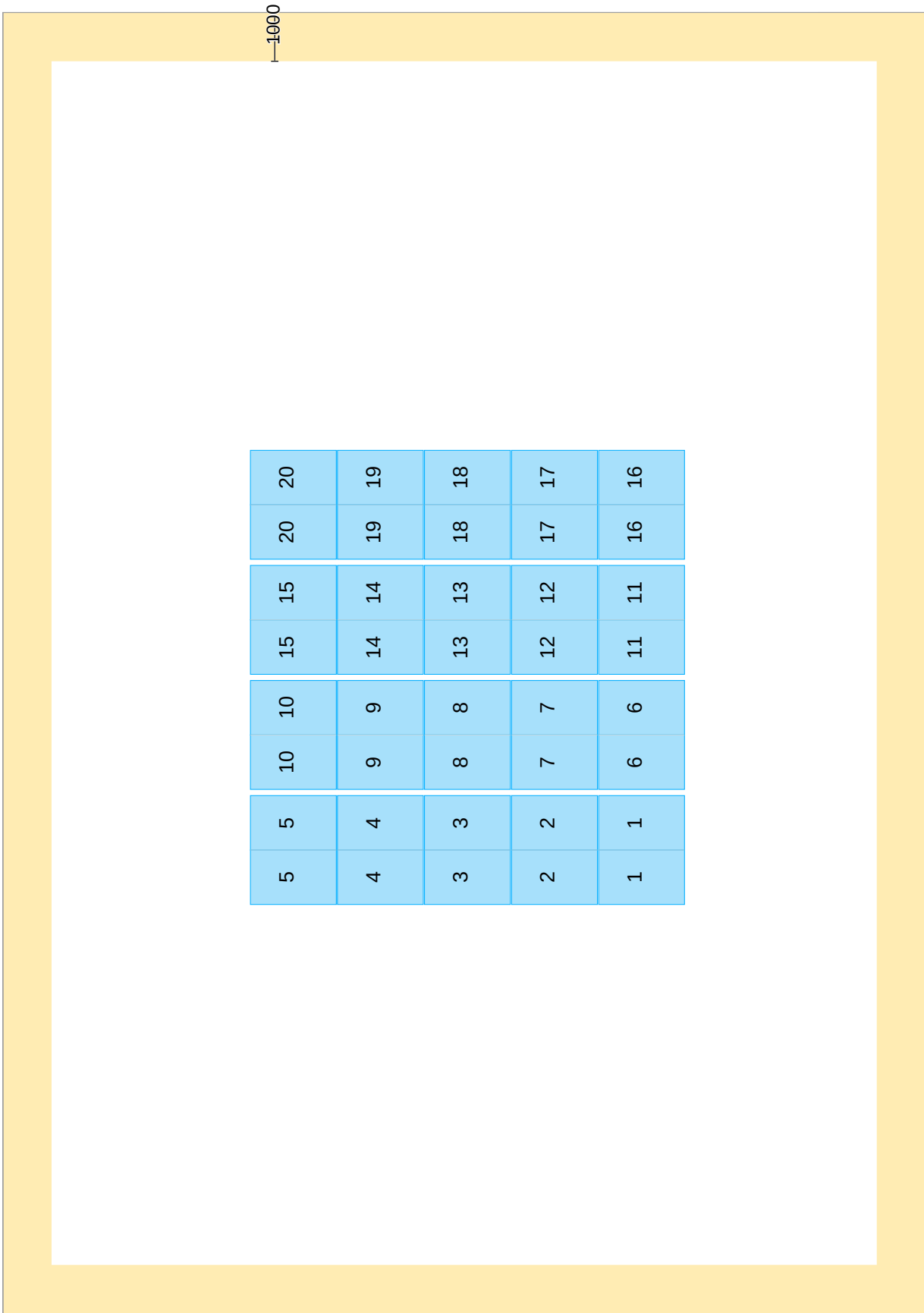




Ballast value[kg] (Blocks with 10 kg) / Sum of ballast stones: 76

7 (1)	11 (2)	16 (2)	25 (3)
(12 x 1)	(8 x 2)	(12 x 2)	(8 x 3)





BILL OF MATERIAL

Article No.	Article	Quantity	Ordering Unit	Weight/Piece	Weight
R420081-BE	End clamp+ (black)	32	1	0,064 kg	2,048 kg
R420082-BE	Middle clamp+ (black)	64	1	0,063 kg	4,032 kg
R500227	FS Pro Securing bolt	24	1	0,008 kg	0,192 kg
R500232	FS Pro 10-EW Eave support	6	1	0,196 kg	1,176 kg
R500261	FS Pro Potential equalisation clip EW	18	1	0,015 kg	0,270 kg
R500271	FS Pro Roof protection pad 110	12	1	0,006 kg	0,072 kg
R520223	FS Pro 10-EW Base rail 2300 (Set)	24	1	2,775 kg	66,600 kg
				Total Weight: 74,390 kg	

ROOF STATICS

ROOF STATICS

Total weight	1459 kg
Module weight	824 kg
Ballast	560 kg
Max ballast	25 kg
Roof size	505,12 m ²
Weight per total roof area	2,89 kg/m ²
Mounting system weight	74,39 kg
Max rail pressure	6 kN/m ²

MODULE FIELD STATICS

FIELD1

Total weight	1459 kg
Module weight	824 kg
Ballast	560 kg
Max ballast	25 kg
Field area	82,95 m ²
Weight per field area	17,59 kg/m ²
Mounting system weight	74,39 kg
Max rail pressure	6 kN/m ²

LOAD ASSUMPTIONS

Dead load

Solar modules type DM465M10RT-54HBW are used.

Dimensions: 1762 mm x 1134 mm

Weight: G = 20.6 kg

Snow load

The determination of the snow load is carried out according to BS EN 1991-1-3:2003/NA:2010-06.

Snow-trap formation or snow-load accumulations are not considered in the calculation. Please contact Renusol if necessary.

Height above sea level: 61 m

Snow load zone: 3

Roof pitch: $\alpha = 0^\circ$

Module elevation: $\beta = 10^\circ$

total pitch: 10.0°

Period of use: 25 Year

Snow load: $s_k = s_{k, 50} * f_s = 0.50 \text{ kN/m}^2 * 0.93 = 0.46 \text{ kN/m}^2$

$\mu_{t1} = 0.800$

$s_1 = \mu_{t1} * s_k = 0.8 * 0.46 \text{ kN/m}^2 = 0.371 \text{ kN/m}^2$

$s_{1, 10^\circ} = 0.371 \text{ kN/m}^2 * \cos(10.0^\circ) = 0.371 \text{ kN/m}^2$

Wind load

The determination of the wind load is carried out according to BS EN 1991-1-4:2005/NA:2011-01.

Building height roof ridge: 6 m

Terrain category: Town terrain

Basic wind velocity: 22.50 m/s

Distance to shoreline: 50.000 km

Distance inside town terrain: 2.000 km

Period of use: 25 Year

Pressure of the gusts velocity: $q(z) = 0.592 \text{ kN/m}^2$

STATIC CALCULATION

Parameters

$\gamma_G = 0.9$	Partial safety factor self-weight
$\gamma_Q = 1.5$	Partial safety factor wind
$A_M = 2.00 \text{ m}^2$	Module surface area
$\beta_M = 10.0^\circ$	Module elevation
$m = 45.2 \text{ kg}$	Masse eines Modultisches (2 Module incl. Unterkonstruktion)
$\alpha = 0^\circ$	Roof pitch
$\mu = 0.5$	Friction coefficient
$q_p = 0.592 \text{ kN/m}^2$	Pressure of the gusts velocity
$g = 9.81 \text{ m/s}^2$	Gravity

Coefficients and factors

n	Number of double-panels taken into account as connected
$80 \text{ m}^2 \leq A_{\text{eff}} = 2 * n * A_M \leq 930 \text{ m}^2$	Effectiv modul area
$k_A = 1 - 0.49 * \lg(A_{\text{eff}}/80\text{m}^2) / \lg(930/80)$	Coefficient of effective module surface
$k_R = 1.6$	Coefficient for modules close to the edge of the roof
k_p	Coefficient for parapet height
$k_\alpha = \mu / (\mu * \cos(\alpha) - \sin(\alpha)) = 1.00$	Coefficient for the inclination of the roof in case of sliding
$cp_1^A, cp_2^A, cp_1^B, cp_2^B$	Pressure coefficients for panel A and panel B (east-west)

Total pressure coefficients

$$c_1^A = cp_1^A * k_p * k_A * k_R$$

$$c_2^A = cp_2^A * k_p * k_A * k_R$$

$$c_1^B = cp_1^B * k_p * k_A * k_R$$

$$c_2^B = cp_2^B * k_p * k_A * k_R$$

Acting forces

$$F_z^A = -q_p * A_M * \cos(\beta_M) * (c_1^A + c_2^A)$$

$$F_x^A = q_p * A_M * \sin(\beta_M) * |c_1^A - c_2^A|$$

$$F_z^B = -q_p * A_M * \cos(\beta_M) * (c_1^B + c_2^B)$$

$$F_x^B = q_p * A_M * \sin(\beta_M) * |c_1^B - c_2^B|$$

Vertical load - System A
Horizontal load - System A
Vertical load - System B
Horizontal load - System B

Ballast for a double panel

$$G_W^A = k_\alpha * \gamma_Q * (F_x^A / \mu + F_z^A) / \gamma_G$$

$$G_W^B = k_\alpha * \gamma_Q * (F_x^B / \mu + F_z^B) / \gamma_G$$

$$G_W = 0.40 * G_W^A + 0.60 * G_W^B$$

$$G_A^A = \cos^{-1}(\alpha) * \gamma_Q * F_z^A / \gamma_G$$

$$G_A^B = \cos^{-1}(\alpha) * \gamma_Q * F_z^B / \gamma_G$$

$$G_A = 0.40 * G_A^A + 0.60 * G_A^B$$

$$B = \text{MAX}(G_W, G_A) / g - m$$

Overall calculated force in case of sliding - System A
Overall calculated force in case of sliding - System B
Overall calculated force in case of sliding
Ballast required - System A
Ballast required - System B
Ballast required
Required ballast

STATIC CALCULATION

Module	Ballast [kg]	Load case	k_R	n	k_p	cp_1^A	cp_2^A	cp_1^B	cp_2^B
1	49.1	Lifting	1.0	4	1.170	-0.152	-0.066	-0.540	0.007
2	32.6	Lifting	1.0	6	1.170	-0.117	-0.062	-0.401	-0.039
3	32.6	Lifting	1.0	6	1.170	-0.117	-0.062	-0.401	-0.039
4	32.6	Lifting	1.0	6	1.170	-0.117	-0.062	-0.401	-0.039
5	49.1	Lifting	1.0	4	1.170	-0.152	-0.066	-0.540	0.007
6	22.2	Lifting	1.0	6	1.170	-0.115	-0.056	-0.356	-0.015
7	13.3	Sliding	1.0	20	1.045	-0.174	0.091	-0.303	0.087
8	13.3	Sliding	1.0	20	1.045	-0.174	0.091	-0.303	0.087
9	13.3	Sliding	1.0	20	1.045	-0.174	0.091	-0.303	0.087
10	22.2	Lifting	1.0	6	1.170	-0.115	-0.056	-0.356	-0.015
11	22.2	Lifting	1.0	6	1.170	-0.115	-0.056	-0.356	-0.015
12	13.3	Sliding	1.0	20	1.045	-0.174	0.091	-0.303	0.087
13	13.3	Sliding	1.0	20	1.045	-0.174	0.091	-0.303	0.087
14	13.3	Sliding	1.0	20	1.045	-0.174	0.091	-0.303	0.087
15	22.2	Lifting	1.0	6	1.170	-0.115	-0.056	-0.356	-0.015
16	49.1	Lifting	1.0	4	1.170	-0.152	-0.066	-0.540	0.007
17	32.6	Lifting	1.0	6	1.170	-0.117	-0.062	-0.401	-0.039
18	32.6	Lifting	1.0	6	1.170	-0.117	-0.062	-0.401	-0.039
19	32.6	Lifting	1.0	6	1.170	-0.117	-0.062	-0.401	-0.039
20	49.1	Lifting	1.0	4	1.170	-0.152	-0.066	-0.540	0.007

TOTAL BILL OF MATERIAL

Article No.	Article	Quantity	Ordering Unit	Weight/Piece	Weight
R420081-BE	End clamp+ (black)	184	1	0,064 kg	11,776 kg
R420082-BE	Middle clamp+ (black)	200	1	0,063 kg	12,600 kg
R500227	FS Pro Securing bolt	96	1	0,008 kg	0,768 kg
R500232	FS Pro 10-EW Eave support	19	1	0,196 kg	3,724 kg
R500261	FS Pro Potential equalisation clip EW	77	1	0,015 kg	1,155 kg
R500271	FS Pro Roof protection pad 110	38	1	0,006 kg	0,228 kg
R520223	FS Pro 10-EW Base rail 2300 (Set)	96	1	2,775 kg	266,400 kg
				Total Weight: 296,651 kg	

IMPORTANT NOTES

The Project Report is a result of information provided by the Customer ("Customer" means customer of Renusol ordering this Project Report from the technical service of Renusol or user of the PV Configurator creating this Project Report himself). Renusol has neither verified the accurateness nor the completeness of the information and data provided by the Customer, which form the basis of this Project Report. It is the responsibility of the Customer to check and verify all input variables (including but not limited to those input variables which had been pre-set with proposed values) and assumptions used in the Project for their accuracy and correctness.

These verifications shall include but not be limited to the following aspects: (a) Wind and snow loads are proposed by the PV Configurator using respective wind and snow load maps. It should be verified that the local conditions do not deviate from the values used in the Configuration (e.g. location on mountain with higher snow load). (b) The Customer shall check and verify the Failure Consequence Class ("CC"). Typical residential and commercial buildings require CC 2. The Customer shall use higher CC in sensitive local environment (e.g. public building, high frequency of visitors, vicinity with potential for severe damages). (c) The service lifetime of the PV installation shall be verified by the Customer depending on the expectation of the ultimate user of the PV installation as well as the lifetime of the other components used in the installation. If the lifetime is expected beyond the service lifetime used for this Project Report, all relevant structural properties as well as input variables and assumptions shall be re-checked using the then expected service lifetime. (d) For flat roof systems: The Customer shall in any case measure and document the friction coefficient of the PV system on the location-specific roof cover it is placed on. The measurement shall be performed in various, at least three roof areas. (e) For flat roof systems: The PV Configurator proposes a ballast calculation. The ballast forms, together with the weight of the PV mounting system itself and the weight of the module, the total weight of the system. The actual ballast applied may in no case be lower than the values proposed by the PV Configurator. The ballast applied shall furthermore be documented. If the ballast applied cannot be precisely determined, a safety factor increasing the ballast is to be applied.

To the extent values of input variables measured or observed by the Customer differ from values used in this Project Report, the configuration of the PV installation shall be re-iterated using the respective correct values.

To the extent this Project Report includes a data concerning structural properties, it is the responsibility of the Customer to professionally verify (have verified) the structural data with regards to its compliance with the applicable local laws and properties of the location for which the Project Report has been prepared.

Furthermore the Terms of Use of the Renusol PV Configurator (<https://www.pv-configurator.com/pages/terms>) and the General Terms and Conditions (https://www.renusol.com/files/content/Downloads/Rechtliche%20Dokumente/Renusol_AGB_EN_110406.pdf) apply. The General Installation Guidelines of Renusol as well as the Installation Manuals and Data Sheets of the respective Renusol products, have likewise to be complied to.



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