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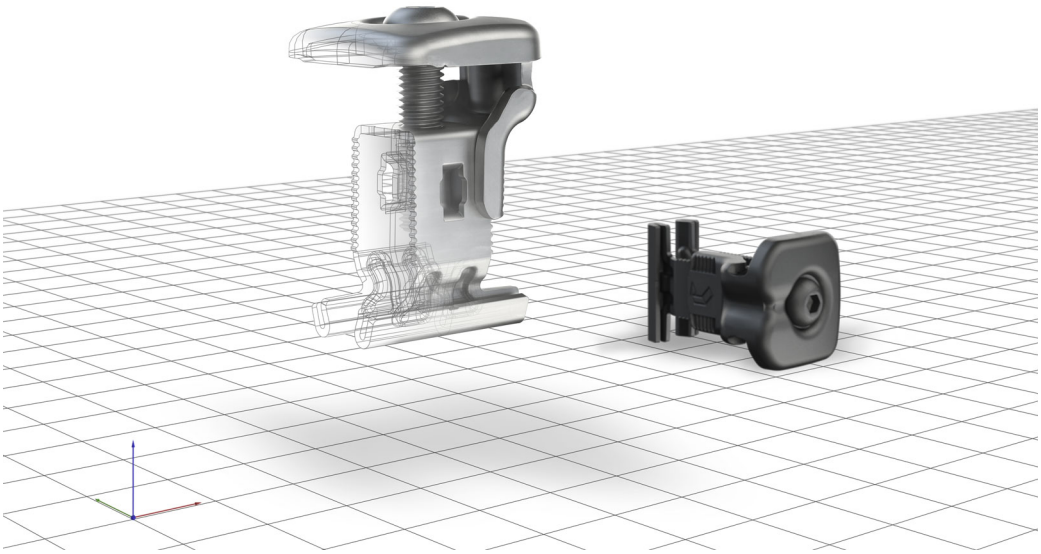
Technical project overview

Swafield Hall

Building project	Swafield Hall
Date	13.04.2023
In-house project no.	PA_230413_507368
Editor	Swafield Hall
Link to configurator	Open link
Number of modules	49
Rated output	20.58 kWp



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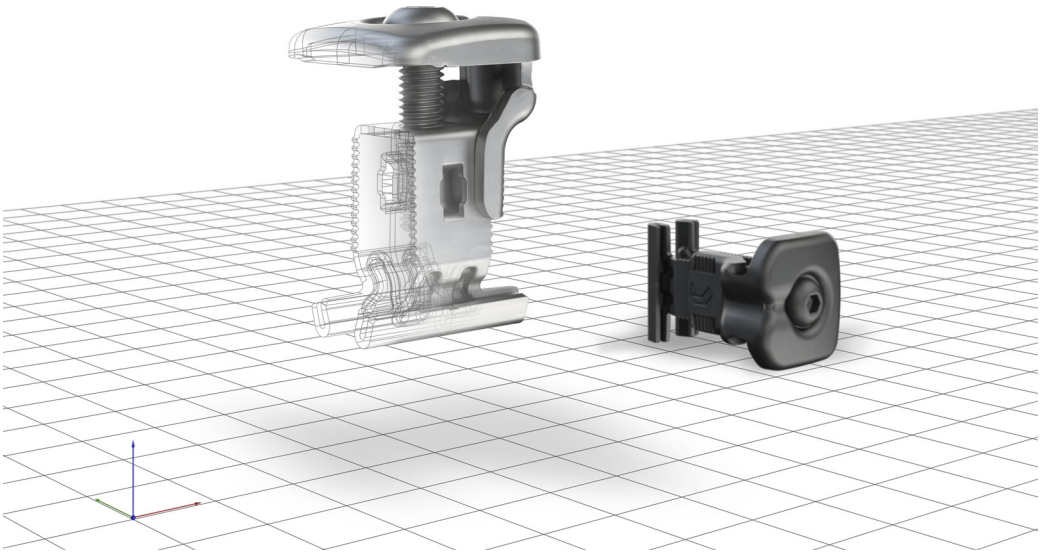
Technical project overview

Swafield Hall

Building project	Swafield Hall
Address	Knapton Road , NR28 0RP Swafield
Country	United Kingdom
Module Type	JinkoSolar Holding Co. Ltd. - JKM-420N-54HL4 Tiger Neo N-Type
Number of modules	49
Rated output	20.58 kWp
Mounting system	ConSole+
Editor	Swafield Hall



LOCATION

Street	Knapton Road
City	NR28 0RP Swafield
Country	United Kingdom

SURROUNDINGS

Code	Eurocode NA GB
Terrain height above sealevel	31,00 m
Snow load zone	Zone 3
Terrain category	Country
Distance to coast	3,00 km
Surroundings	covered
Service life of PV system	25 years
Failure consequence class	2
Partial safety factor dead load (ballast)	1

LOAD CALCULATION RESULT

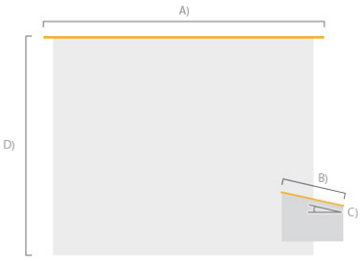
Peak velocity pressure	0,52 kN/m^2
Snow load	0,46 kN/m^2
Snow load on roof	0,37 kN/m^2
Base wind speed ($V_{b,0}$)	23,50 m/s

TOPOGRAPHY

Topography	Not exposed

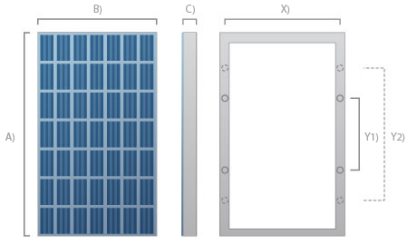
ROOF PROPERTIES

Roof type	Flat roof
Coverage type	Gravel
A) Roof length	17,00 m
B) Roof segment width	22,00 m
C) Roof pitch	0,00 º
D) Building height	0,00 m
Parapet height	0,00 mm
Parapet width	0,00 mm
Rotation	0,00 º



MODULE PARAMETERS

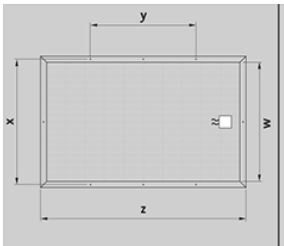
Manufacturer	JinkoSolar Holding Co. Ltd.
Name	JKM-420N-54HL4 Tiger Neo N-Type
Length	1722 mm
Width	1134 mm
Height	30 mm
Weight	22 kg
Rated output	420 W_{peak}
Datasheet	Open datasheet
ShowConsoleFasteningCheck	1



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.

Please check

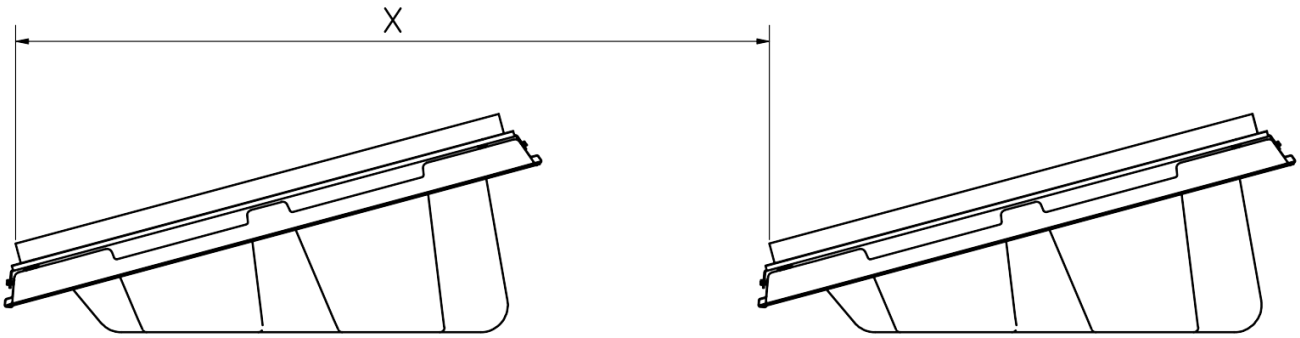


Article No.	*R520075-K*	*R520075-K + R460001*	*R520075-K + R420023*	*R520075-K + R460001 + R420023*
*Modul min. - max. **w:***	-	-	*920 mm - 995 mm*	*996 mm - 1075 mm*
*Modul min. - max. **x:***	*895 mm - 1015 mm*	*1016 mm - 1085 mm*	-	-
*Modul min. - max. **y:***	*690 mm - 1180 mm*	*690 mm - 1180 mm*	-	-
*Modul min. - max. **z:***	*1550 mm - 2400 mm*	*1550 mm - 2400 mm*	*1550 mm - 2400 mm*	*1550 mm - 2400 mm*

SYSTEM

System type	Ballasted
System	ConSole+
Friction coefficient	0,60
Ballast block mass (optional)	10,00 kg
ConSole+ fastening variant	ConSole+ with extension rails
Row distance	2400

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

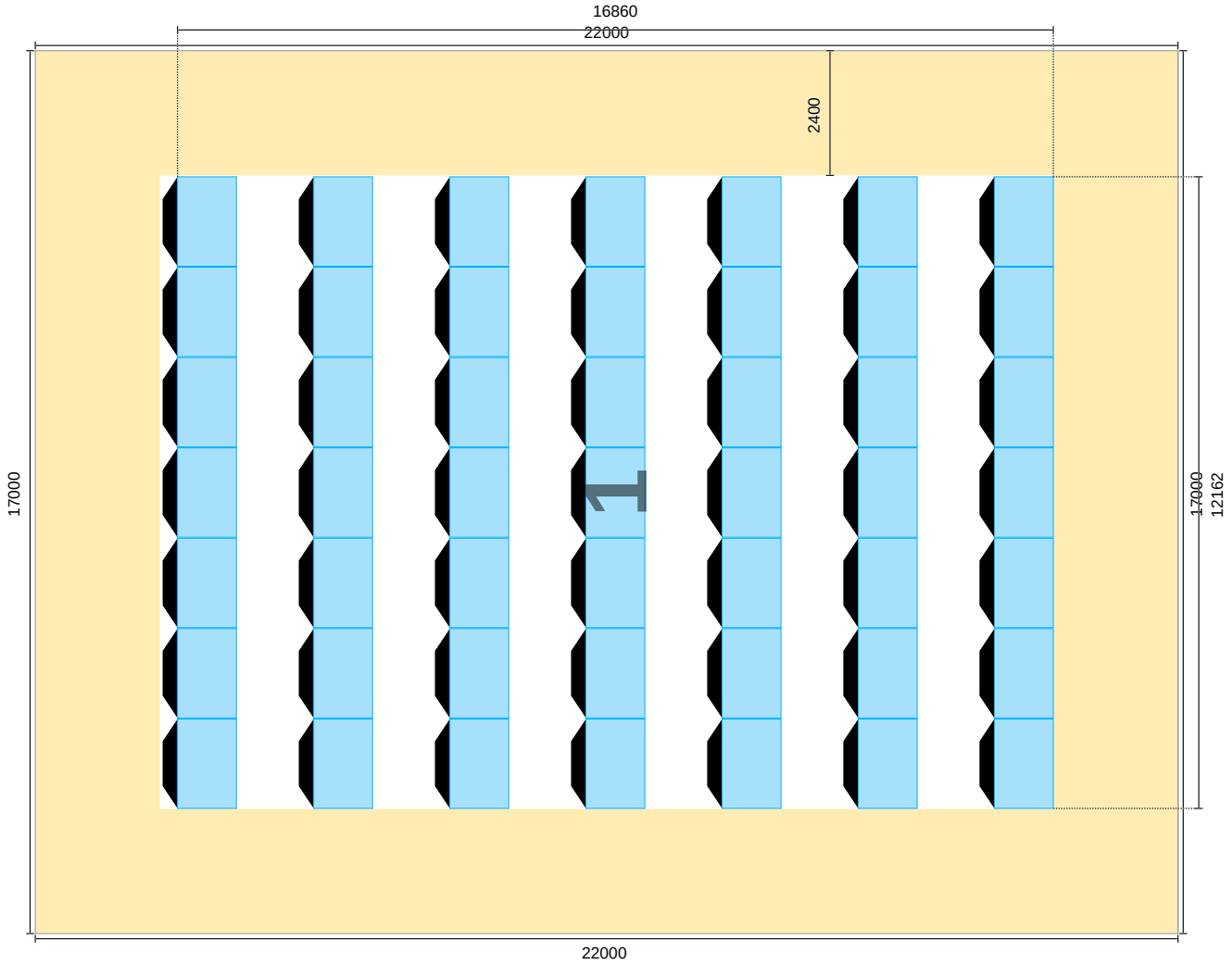


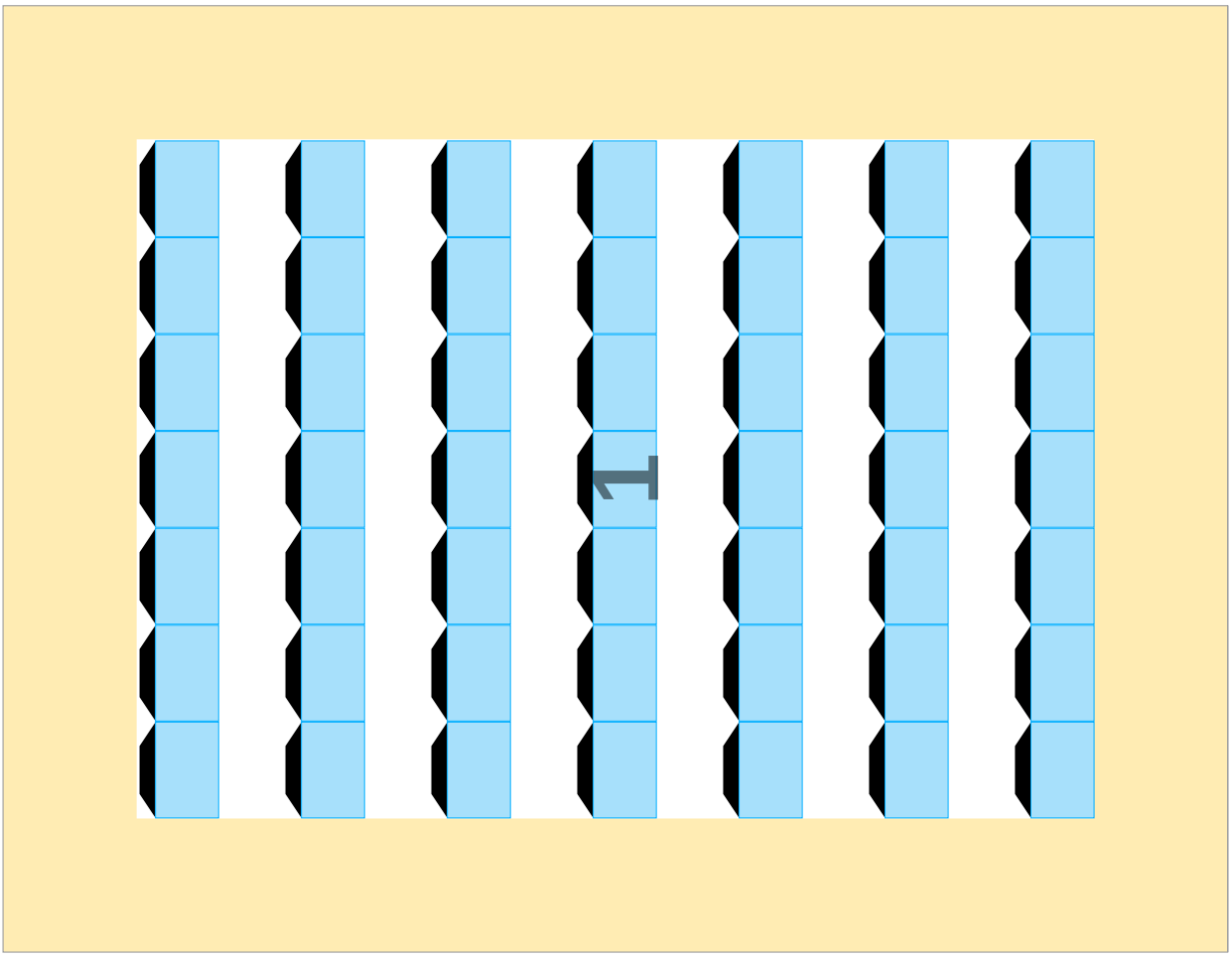
STATIC VALIDATION

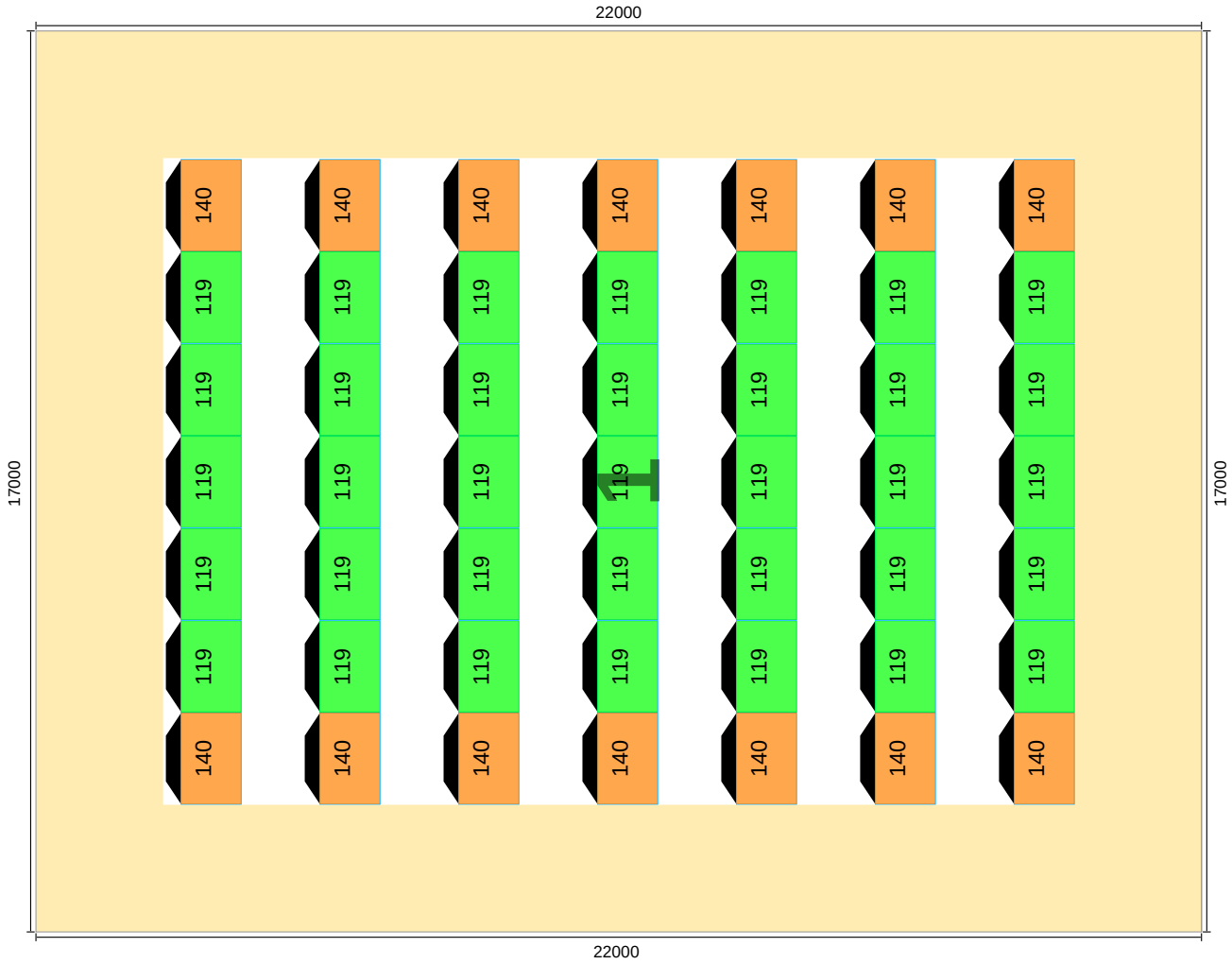
Your project was validated by our statics check successfully.

Maximum ballast value: 140 kg

Ballast: 6137 kg
Modules: 1078 kg
Partlist: 489 kg

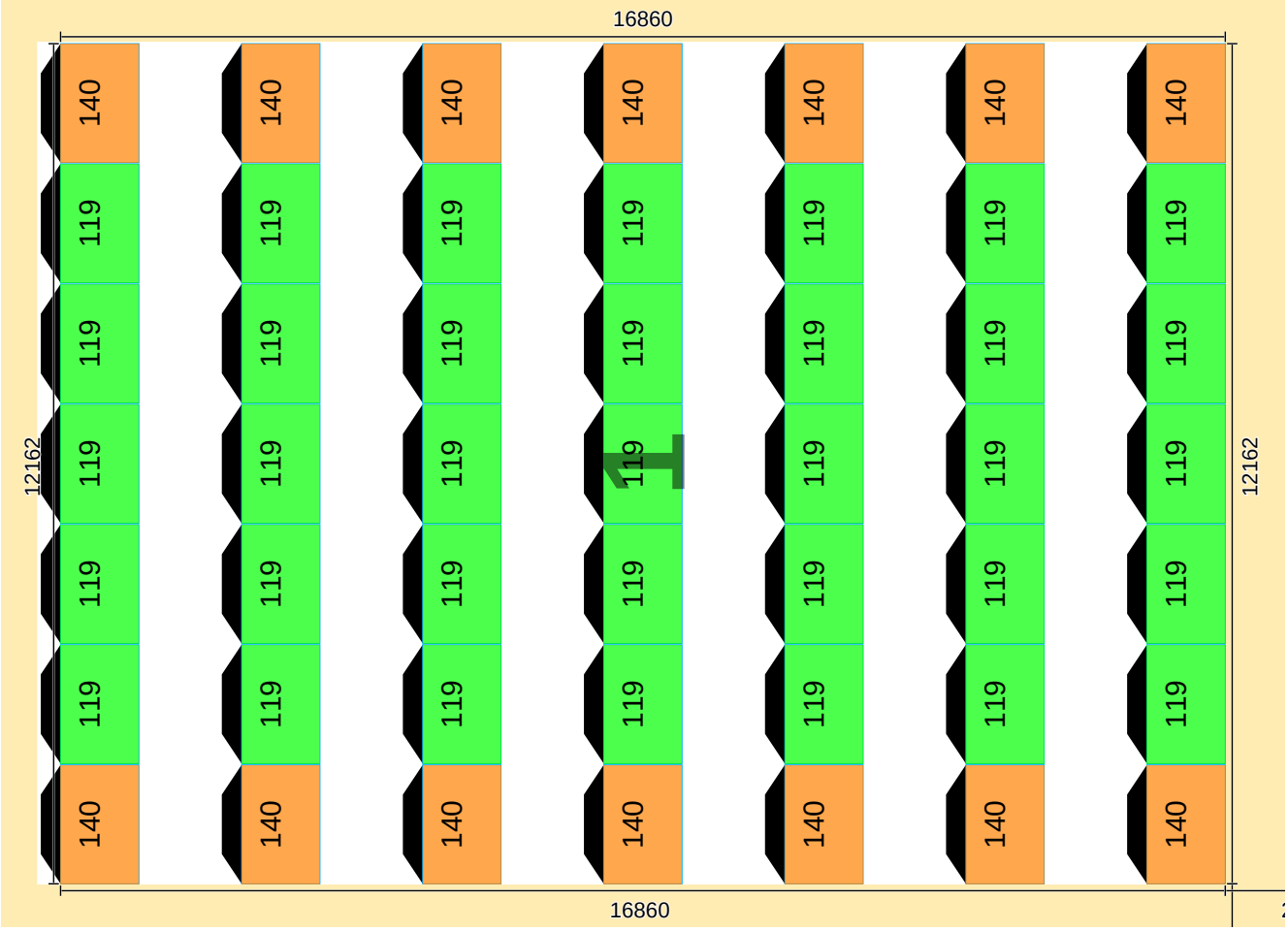

16860
22000
2400
17000
17000
12162
22000





Ballast value[kg] (Blocks with 10 kg) / Sum of ballast stones: 616

119 (12)	140 (14)
(35 x 12)	(14 x 14)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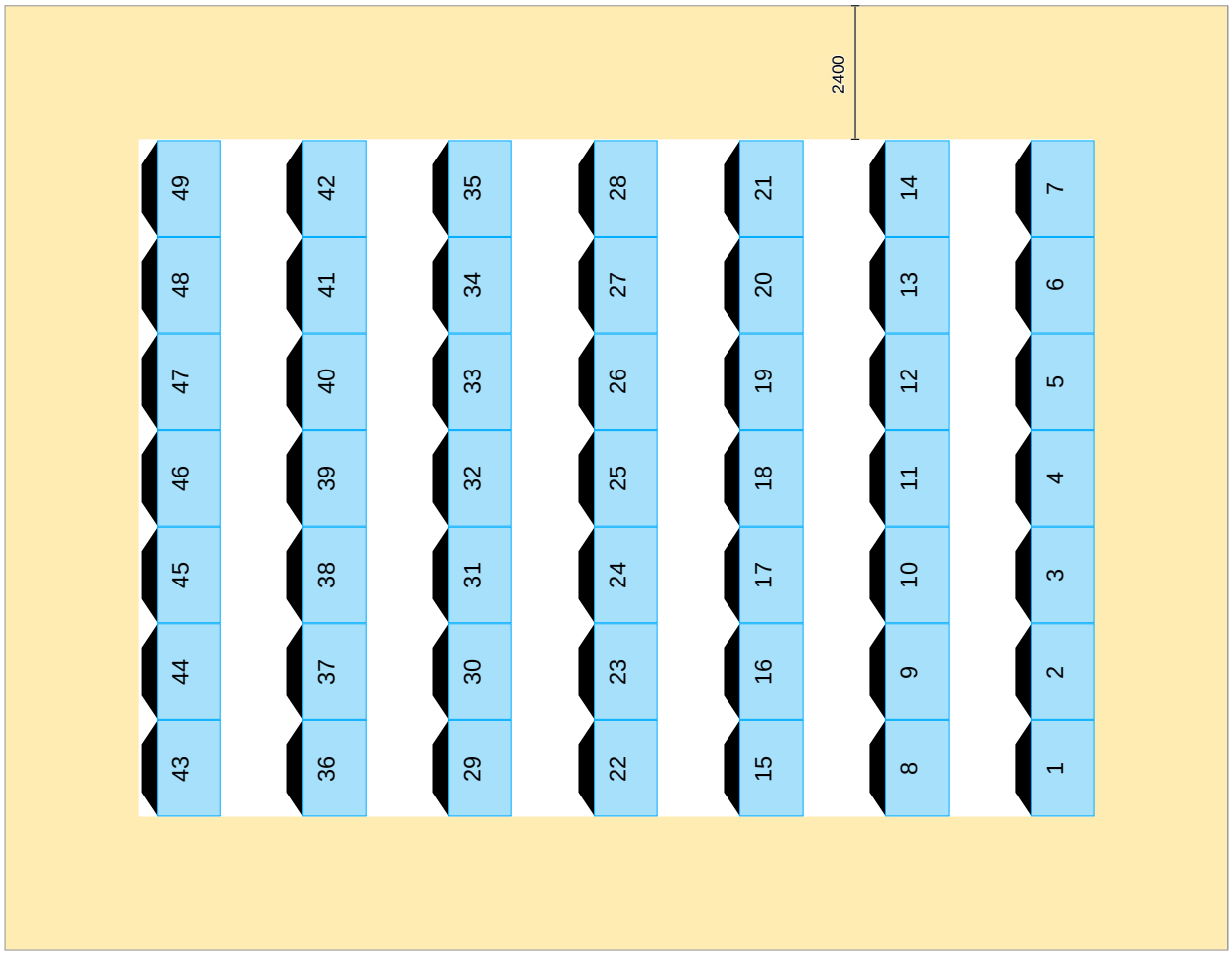
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TOTAL BILL OF MATERIAL

Article No.	Article	Quantity	Ordering Unit	Weight/Piece	Weight
R460001	Elongation rails for ConSole 4.1, 4.2, 5.2, 6.2	49	1	0,114 kg	5,586 kg
R520075-K	ConSole+ (incl. Mounting material and U-Profile)	49	1	7,900 kg	387,100 kg
R520076	Streamliner+	49	1	1,970 kg	96,530 kg
				Total Weight:	489,216 kg

MODULE FIELD STATICS

RLC = Relevant load case
1 = Sliding
2 = Tipping
3 = Lifting

WD = Relevant wind direction
1 = North (against rear wall)
2 = South (against front wall and module)

WP = Wind Profile
S = Stationary
I = Instationary

Module	RLC	WD	WP	γ_Q	γ_G
1	1	1	I	1,35	1,00
2	1	1	I	1,35	1,00
3	1	1	I	1,35	1,00
4	1	1	I	1,35	1,00
5	1	1	I	1,35	1,00
6	1	1	I	1,35	1,00
7	1	1	I	1,35	1,00
8	1	1	I	1,35	1,00
9	1	1	I	1,35	1,00
10	1	1	I	1,35	1,00
11	1	1	I	1,35	1,00
12	1	1	I	1,35	1,00
13	1	1	I	1,35	1,00
14	1	1	I	1,35	1,00
15	1	1	I	1,35	1,00
16	1	1	I	1,35	1,00
17	1	1	I	1,35	1,00
18	1	1	I	1,35	1,00
19	1	1	I	1,35	1,00
20	1	1	I	1,35	1,00
21	1	1	I	1,35	1,00
22	1	1	I	1,35	1,00
23	1	1	I	1,35	1,00
24	1	1	I	1,35	1,00
25	1	1	I	1,35	1,00
26	1	1	I	1,35	1,00
27	1	1	I	1,35	1,00
28	1	1	I	1,35	1,00

Module	RLC	WD	WP	γ_Q	γ_G
29	1	1	I	1,35	1,00
30	1	1	I	1,35	1,00
31	1	1	I	1,35	1,00
32	1	1	I	1,35	1,00
33	1	1	I	1,35	1,00
34	1	1	I	1,35	1,00
35	1	1	I	1,35	1,00
36	1	1	I	1,35	1,00
37	1	1	I	1,35	1,00
38	1	1	I	1,35	1,00
39	1	1	I	1,35	1,00
40	1	1	I	1,35	1,00
41	1	1	I	1,35	1,00
42	1	1	I	1,35	1,00
43	1	1	I	1,35	1,00
44	1	1	I	1,35	1,00
45	1	1	I	1,35	1,00
46	1	1	I	1,35	1,00
47	1	1	I	1,35	1,00
48	1	1	I	1,35	1,00
49	1	1	I	1,35	1,00

LOAD ASSUMPTIONS

Dead load

Solar modules type JKM-420N-54HL4 Tiger Neo N-Type are used.

Dimensions:	1722 mm x 1134 mm
Weight:	G = 22.0 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:	31 m
Snow load zone:	3
Roof pitch:	α = 0°
Module elevation:	β = 15°
total pitch:	0.0°
Period of use:	25 Year
Snow load:	$s_k = s_{k,50} * f_s^i$ = 0.50 kN/m² * 0.93 = 0.46 kN/m²
	μ_1 = 0.800
	$s_1 = \mu_1 * s_k$ = 0.8 * 0.46 kN/m² = 0.371 kN/m²
	$s_{1,0°}$ = 0.371 kN/m² * cos(0.0°) = 0.371 kN/m²

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:	0 m
Terrain category:	Country terrain
Basic wind velocity:	23.50 m/s
Distance to shoreline:	3.000 km
Period of use:	25 Year
Pressure of the gusts velocity:	q(z) = 0.522 kN/m²

:

ANALYSIS

Basics

Only the types of loads net weight and wind load are relevant to the dimensioning (determination of the appropriate ballast). The net weight of the ConSole and the modules is taken from the design load; the ballast required is to be determined by calculation.
The determination of the areas and of the lever arms of the individual forces is based on the present geometry.
The relevant dynamic pressure is determined from the design loads. The wind load report is used for the relevant pressure and suction coefficients.
The wind load types listed in the report result from different wind directions. The respective allocation is broken down by colour in the report. Both stationary and unsteady wind loads need to be taken into account.

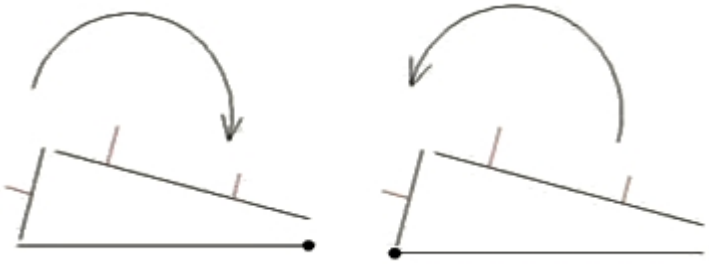
The relevant load type combinations result from Eurocode 1:
1,00 x net weight + 1,35 x wind load (net weight, since it has always a positive effect with only 1,00, wind load as the first leading variable effect with 1,35). The component safety factors are reduced compliant with The letter from Ruschweyh Consult GmbH issued on 26.09.2011

Cases of failure for ConSole:

There are three possible cases of failure. These are examined for all types of wind load. In principle, the prevailing wind load vectors on the partial areas (via cos and sine) are broken down in horizontal and vertical components.

Tipping over

There are two options - the ConSole can tip over the front (southern) or the rear (northern) endpoint.

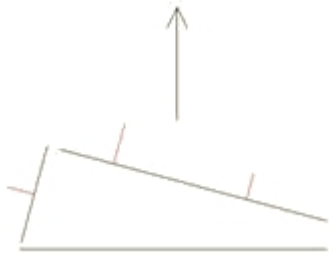


To determine the relevant ballast, total the sum of the moments from all wind loads acting on the ConSole (multiplied by their lever arms) on the rear or front support point, resulting in the tilting moment.
This is set against the "holding moment", calculated from the net weight (+ ballast) and the lever arm to the centre of gravity of its net weight. These two moments must at least be in balance, so the ConSole will not tip over when exposed to wind.

Lifting

The ConSole lifts, if the sum of all vertical forces from wind suction (directed upward) is greater than the existing net weight including ballast.

ANALYSIS



Here, too, all types of wind load are examined.

Sliding

The ConSole slides when the horizontal wind forces are greater than the static frictional force generated by its net weight (including ballast) and the existing coefficient of friction. Both the positive effect of wind pressure and the negative effect of wind suction (directed upward) are taken into account.

Here, Renusol calculates a coefficient of friction of 0.6 (which always has to be checked by the customer on-site with a spring scale).

Special characteristics:

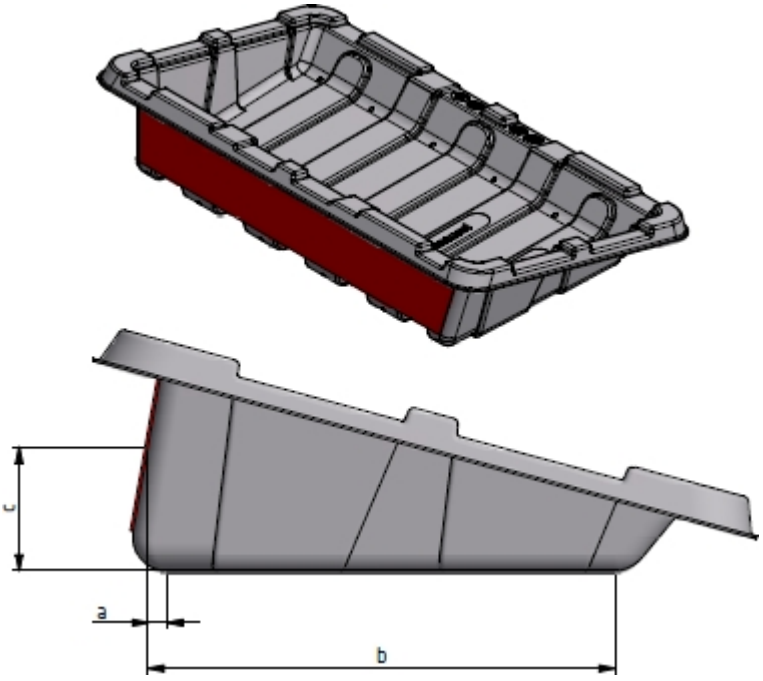
The coloured spaces above are not scalable. For larger module fields, the high-load area remains, the rest is filled by low-load (green or white) fields. If the module fields are smaller, only high-load areas may result.
The edge distances from the building edge in the north, east, and west are fixed at no less than 1.50m. If the edge distances are greater (because only small module areas are installed), the colour scheme will still stay the same - even if the modules are allocated in the middle of the roof. For example the corner areas are still high-load (yellow), i.e. the colour gradients always refer to the module area, not to the building dimensions.
The northern row and the eastern and the western columns are always provided with a wind deflector (see attachment). If individual elements are missing here, the wind deflector is installed in the next (not shaded) element.

The wind load tests for the ConSole+ were carried out on "complete" rectangular module areas. In most cases, missing modules indicate an obstacle in this area. If this obstacle is higher than or at least of equal height to the ConSole, the shading effect remains, i.e. surrounding ConSoles retain the wind loads specified by the respective load models.
However, if the obstacle at this point is smaller than the ConSole or does not exist, the missing modules result in the loss of the wind-deflecting effect for all surrounding modules, i.e. these modules are exposed to increased wind loads. This also applies to modules located in the rows and columns behind the missing modules. In this case, consider the module area to begin anew.

ANALYSIS

Geometry of the without wind deflector

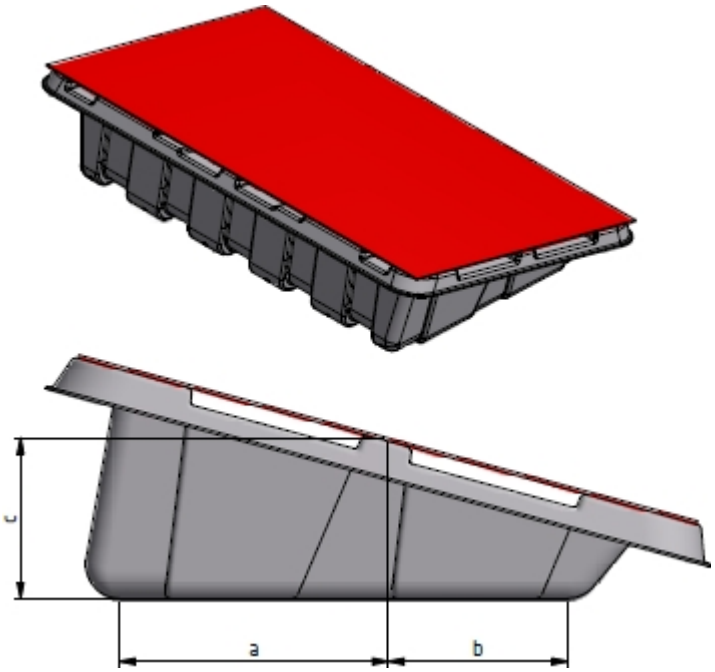
F1 Rear wall without wind deflector



Area:	A = 0.585 m²
Lever arms:	a = -0.030 m
	b = 0.817 m
	c = 0.202 m
Inclination:	80°

ANALYSIS

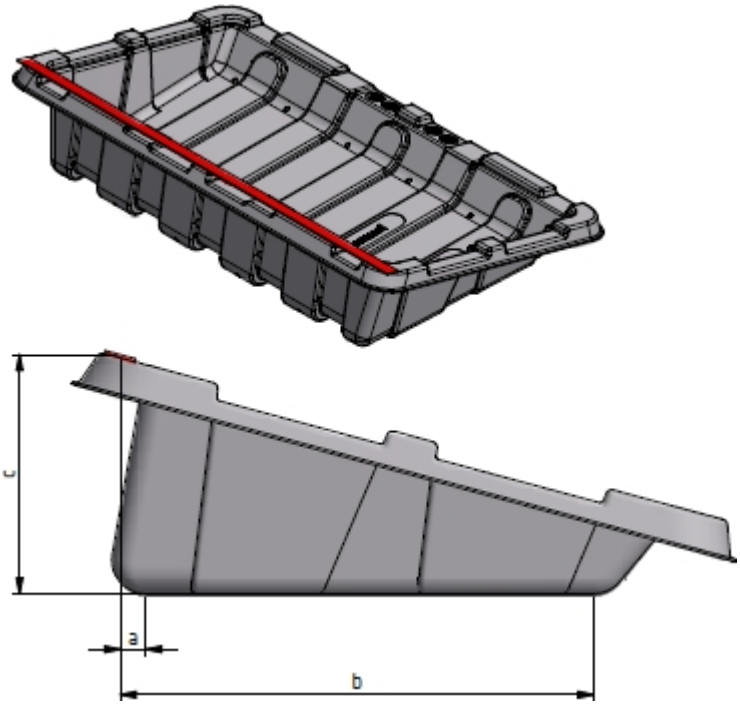
F2 Module area top



Area:	A = 1.848 m²
Lever arms:	a = 0.462 m
	b = 0.325 m
	c = 0.273 m
Inclination:	15°

ANALYSIS

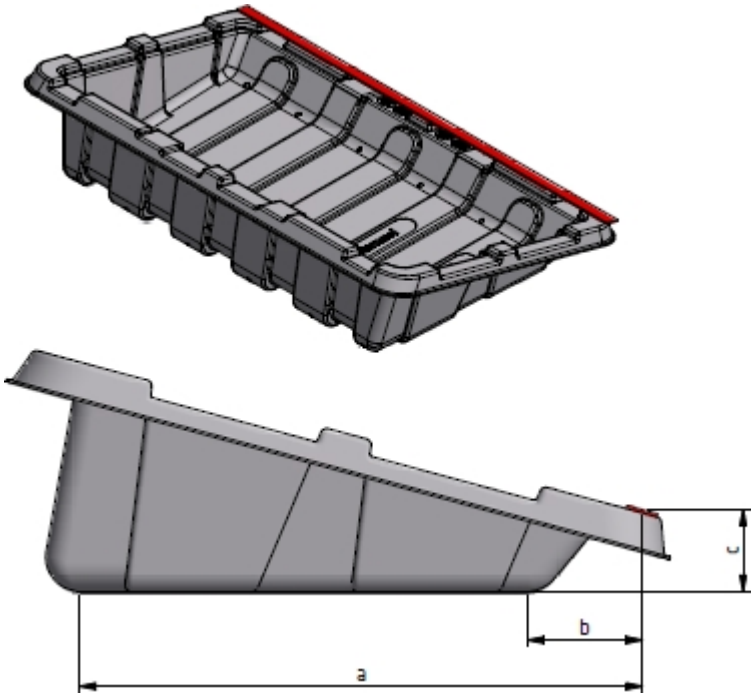
F3 Left excess length of module from the bottom



Area:	A = 0.110 m²
Lever arms:	a = -0.027 m
	b = 0.814 m
	c = 0.404 m
Inclination:	15°

ANALYSIS

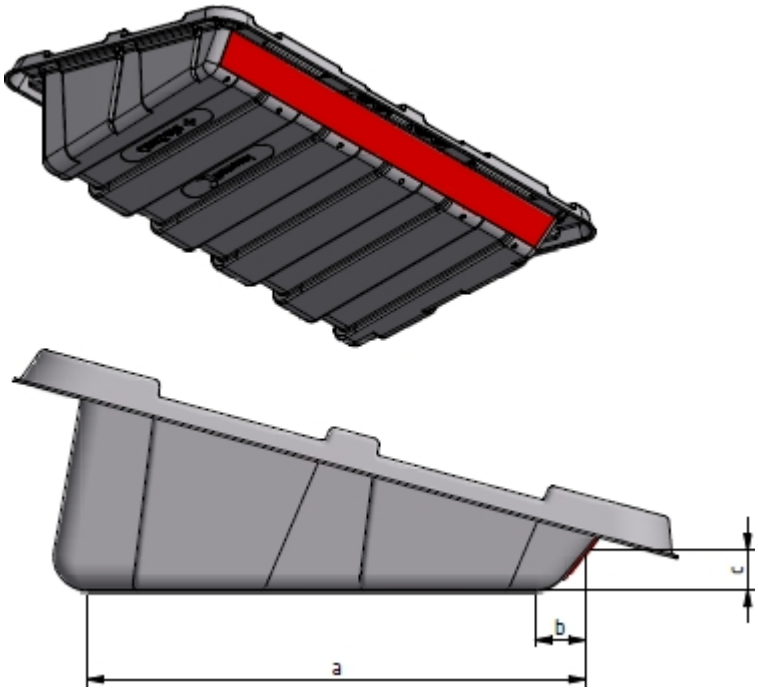
F4 Right excess length of module from the bottom



Area:	A = 0.134 m²
Lever arms:	a = 0.934 m
	b = -0.147 m
	c = 0.146 m
Inclination:	15°

ANALYSIS

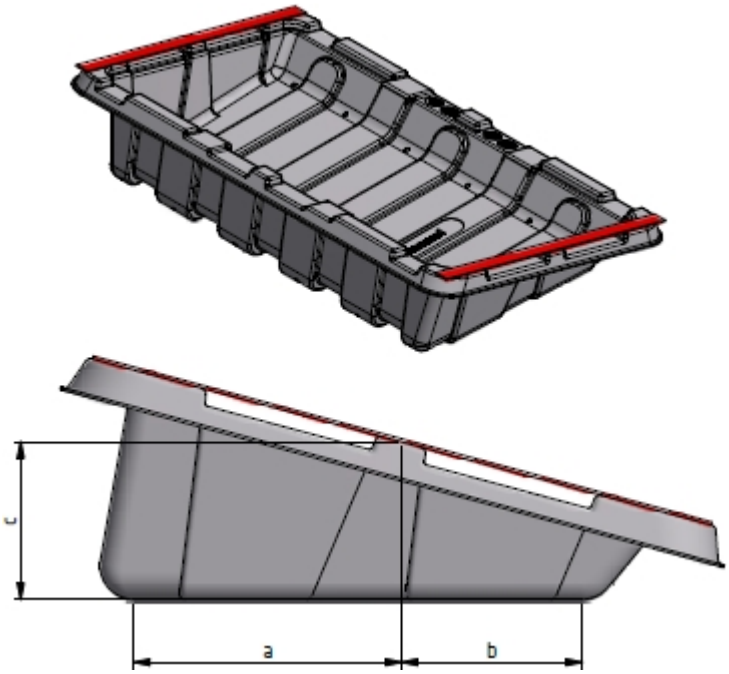
F5 Front wall



Area:	A = 0.268 m²
Lever arms:	a = 0.863 m
	b = -0.076 m
	c = 0.077 m
Inclination:	60°

ANALYSIS

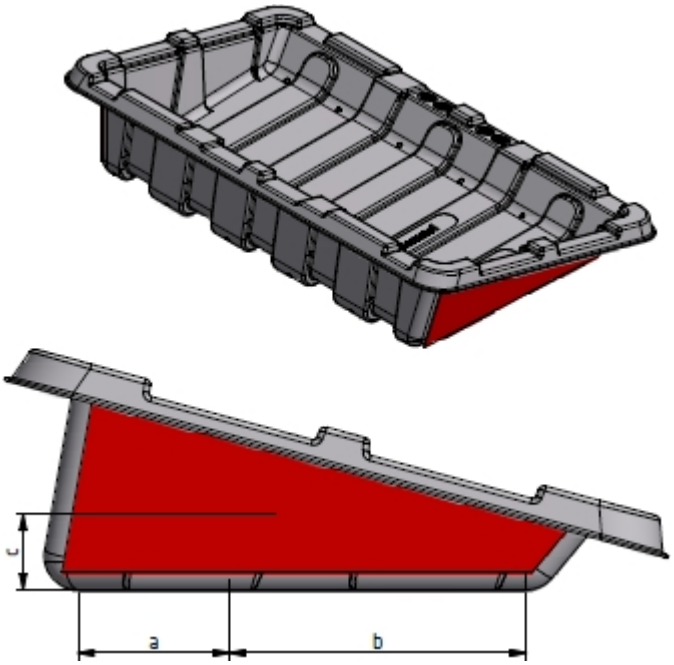
F6 Side excess lengths



Area:	A = 0.168 m²
Lever arms:	a = 0.462 m
	b = 0.325 m
	c = 0.273 m
Inclination:	15°

ANALYSIS

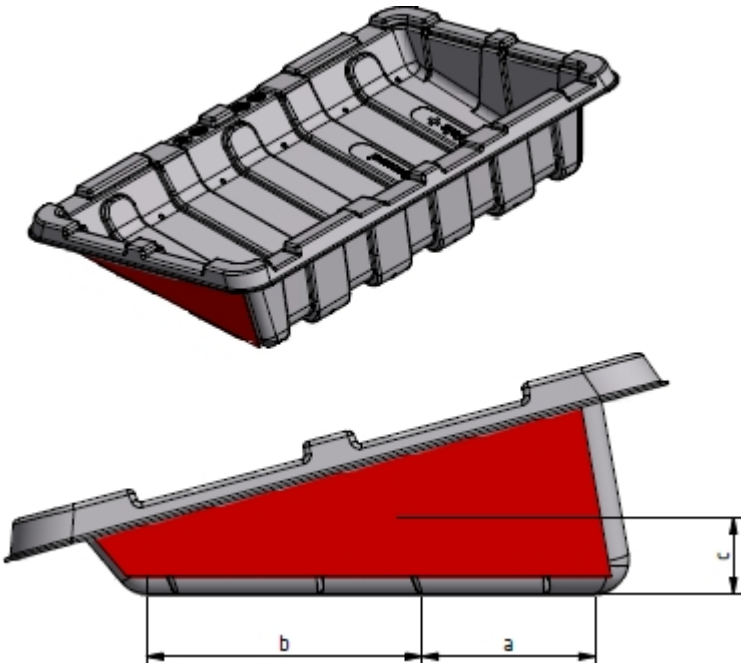
F7 Left wall



Area:	A = 0.278 m²
Lever arms:	a = 0.394 m
	b = 0.394 m
Inclination:	75°

ANALYSIS

F8 Right wall

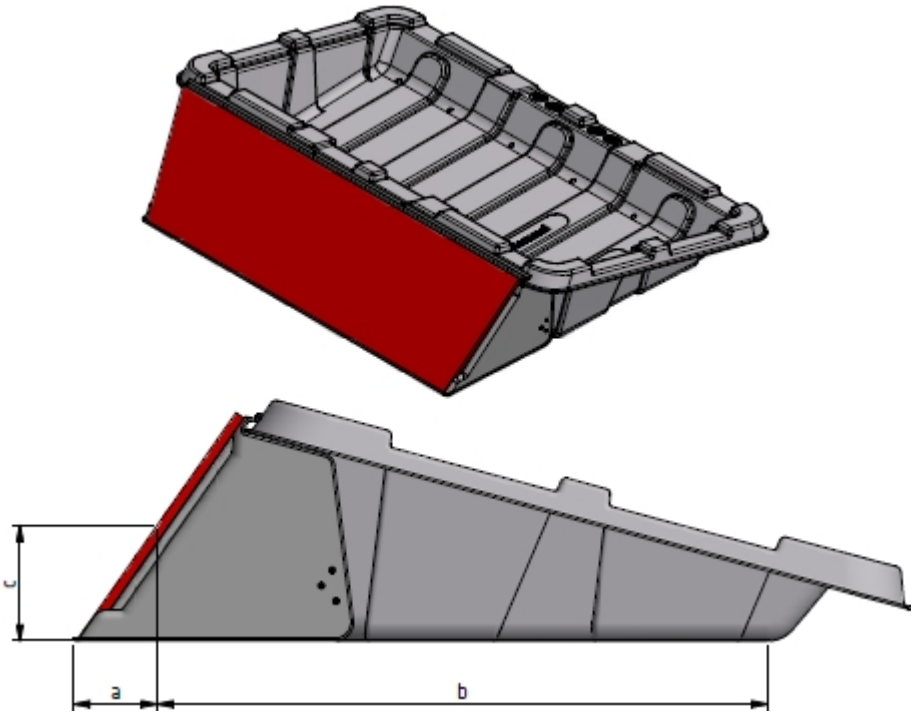


Area:	A = 0.278 m²
Lever arms:	a = 0.394 m
	b = 0.394 m
Inclination:	75°

ANALYSIS

Geometry of the with wind deflector

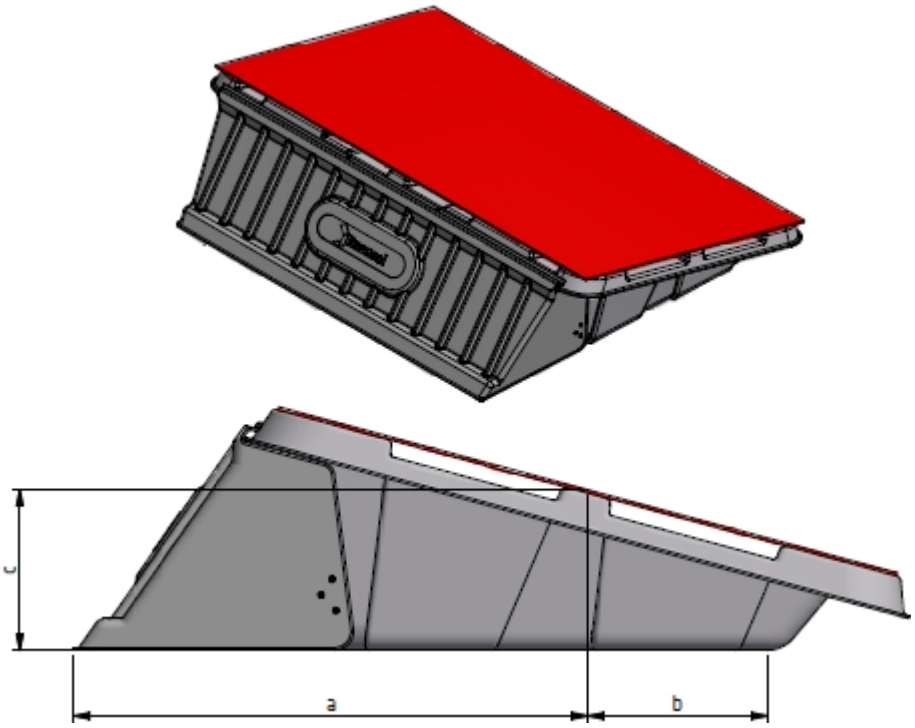
F1 Rear wall with wind deflector



Area:	A = 0.720 m²
Lever arms:	a = 0.144 m
	b = 0.989 m
	c = 0.206 m
Inclination:	55°

ANALYSIS

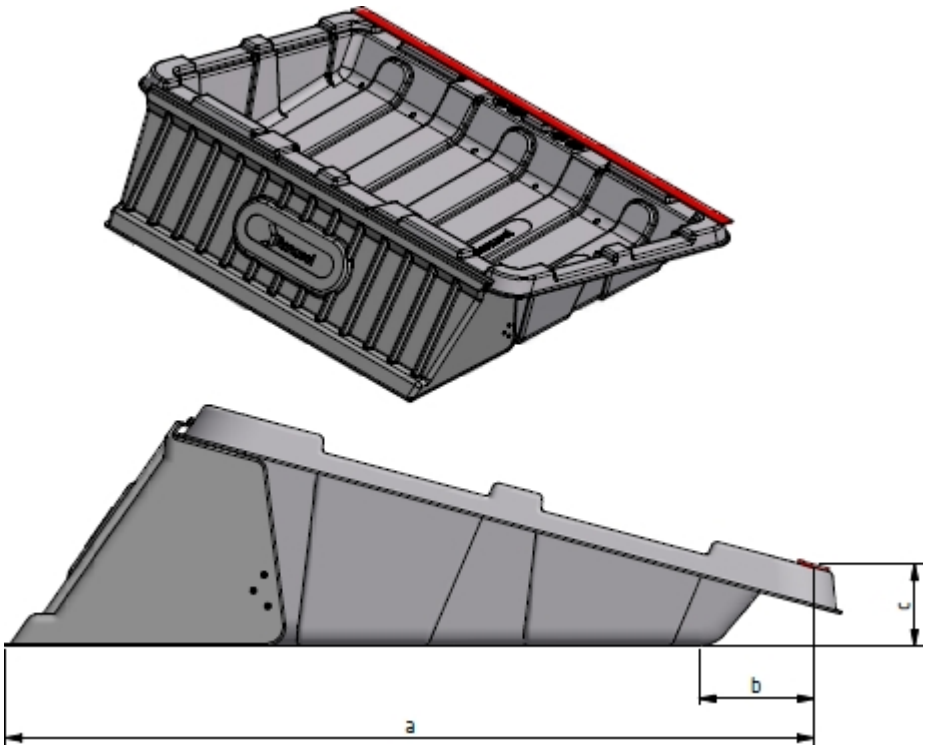
F2 Module area top with wind deflector



Area:	A = 1.848 m²
Lever arms:	a = 0.809 m
	b = 0.325 m
	c = 0.273 m
Inclination:	15°

ANALYSIS

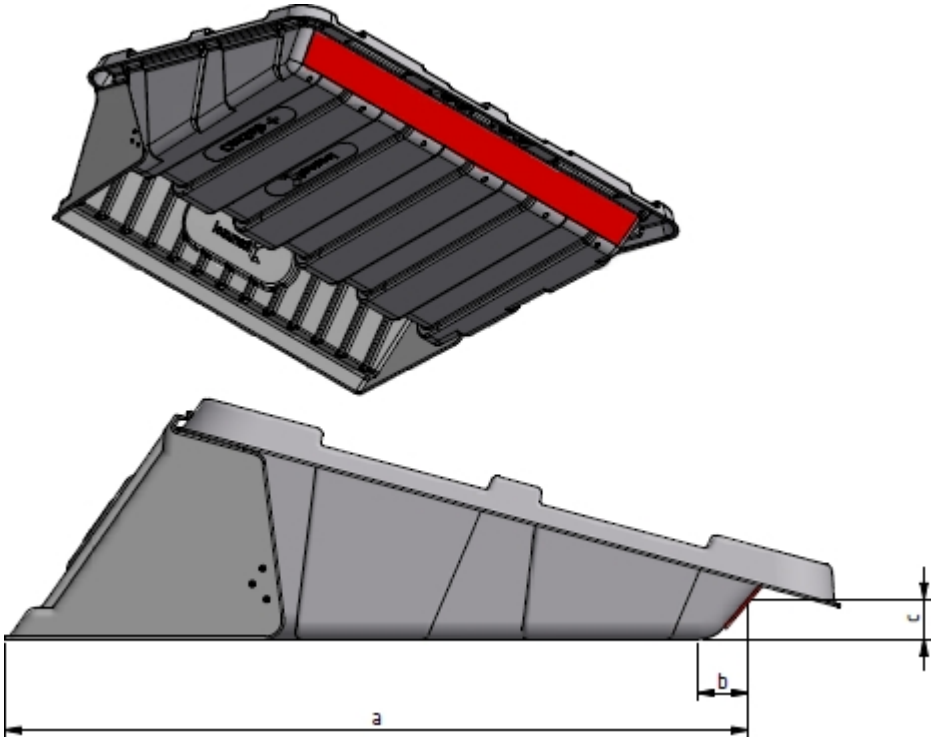
F4 Right excess length of module from the bottom with wind deflector



Area:	A = 0.134 m²
Lever arms:	a = 1.280 m
	b = -0.147 m
	c = 0.146 m
Inclination:	15°

ANALYSIS

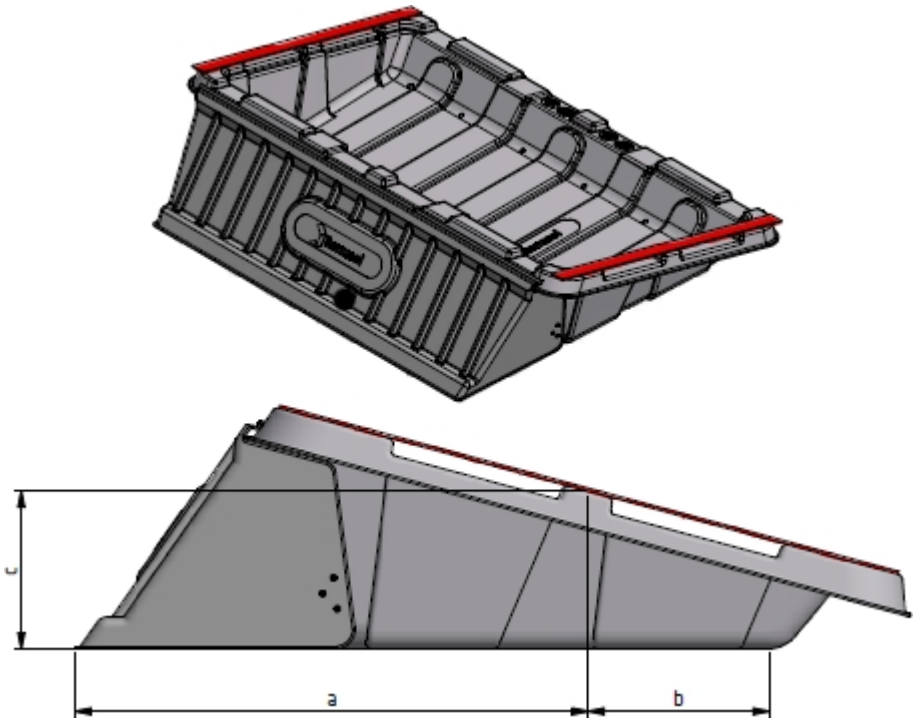
F5 Front wall with wind deflector



Area:	A = 0.268 m²
Lever arms:	a = 1.209 m
	b = -0.076 m
	c = 0.077 m
Inclination:	60°

ANALYSIS

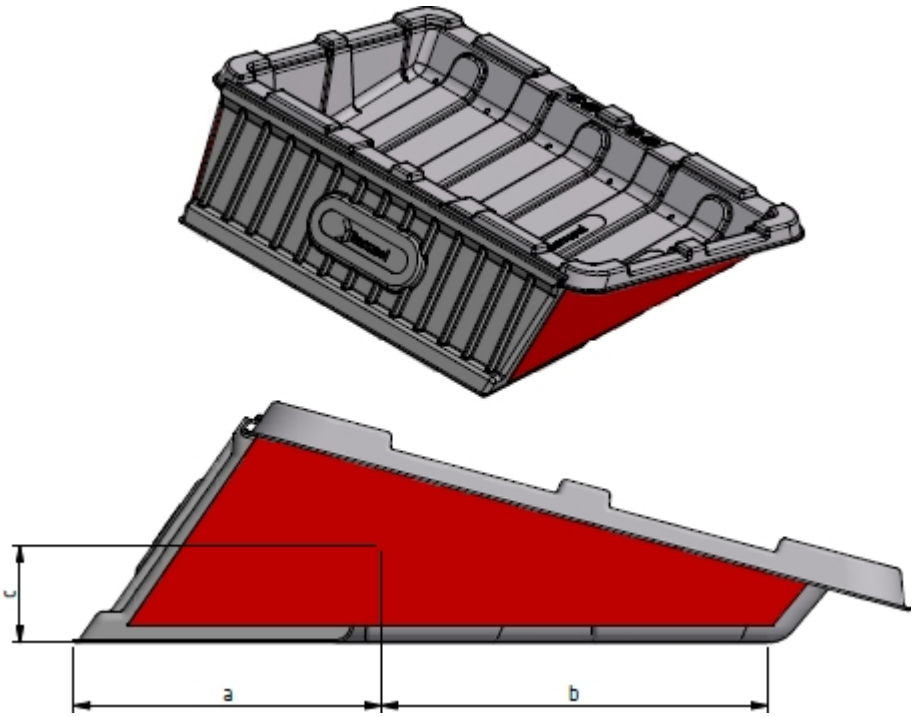
F6 Side excess lengths with wind deflector



Area:	A = 0.168 m²
Lever arms:	a = 0.809 m
	b = 0.325 m
	c = 0.273 m
Inclination:	15°

ANALYSIS

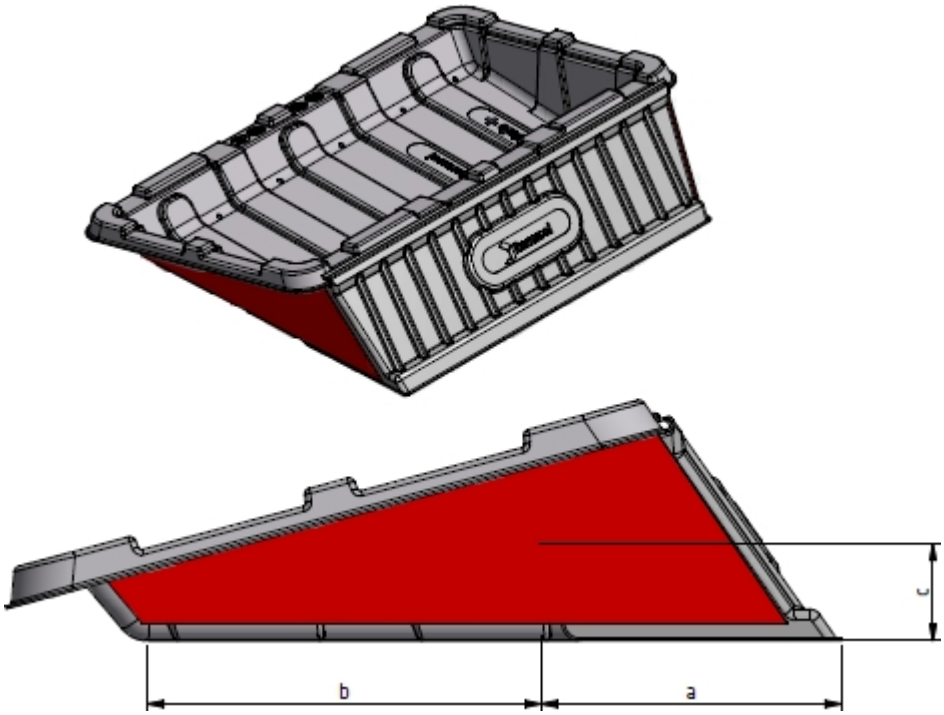
F7 Left wall with wind deflector



Area:	A = 0.348 m²
Lever arms:	a = 0.537 m
	b = 0.596 m
Inclination:	75°

ANALYSIS

F8 Right wall with wind deflector



Area:	A = 0.348 m²
Lever arms:	a = 0.537 m
	b = 0.596 m
Inclination:	75°

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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