EXAMPLE

Solar-nu.nl

Mounting systems for solar technology

K2 systems

K2 SYSTEMS GMBH

CALCULATION BASIS

PROJECT:	New project
AUTHOR:	Solar-nu.nl
DATE:	21/06/2017

PROJECT DATA

GENERAL INFORMATION

Name	New project
Mounting System	S-Rock 15°
Customer	Ton Verbakel
Contact	info@solar-nu.nl
Author	Solar-nu.nl

LOCATION

Address	Zernikestraat 7, 2665 JJ Bleiswijk, Netherlands
Ground elevation	0.00 m
Roof type	Flat roof
Building height	9.00 m
Parapet wall height	0.00 m
Roof pitch	0 °
Edge distance	0.70 m
Friction coefficient	0.30
Terrain category	III: Villages, suburbs, woodlands

The friction coefficients given here must be checked onsite. If a lower value is found, this must be specified here for the ballast calculation!

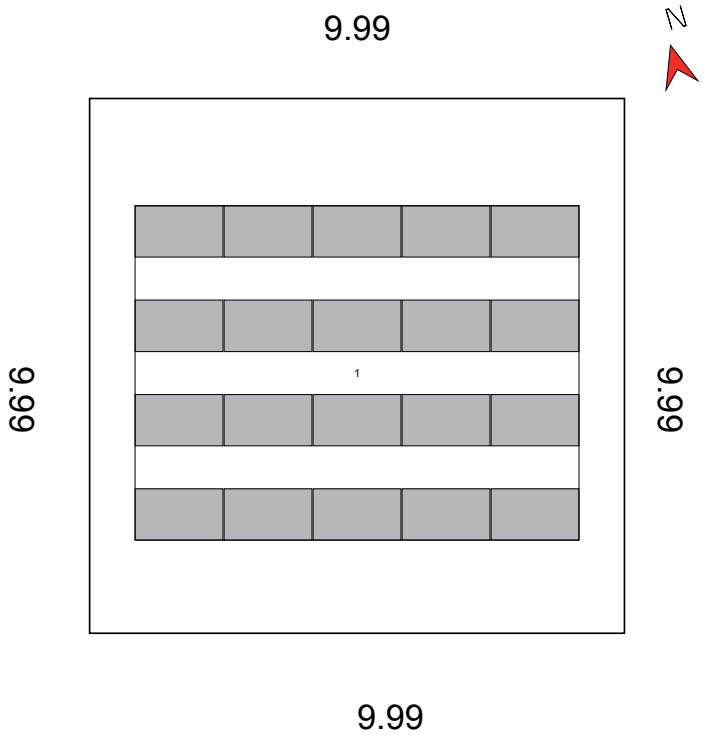
LOADS

Design method	Eurocode		
Failure consequence class (CC)	CC1	Service life	25 years
Peak velocity pressure	$q_{p,25}$= 0.21 kN/m²		
Snow load on ground level	s_k = 10.00 kN/m²		

MODULES

Manufacturer	Zonnepaneel	Quantity	20
Name	Benutzerdefiniert	Output power	5 kWp
dimensions LxWxH	1640 x 992 x 40.0 mm		
Weight	18.5 kg		
Output power	260 W		

ASSEMBLY PLAN



Dimensions in [m]

LEGEND

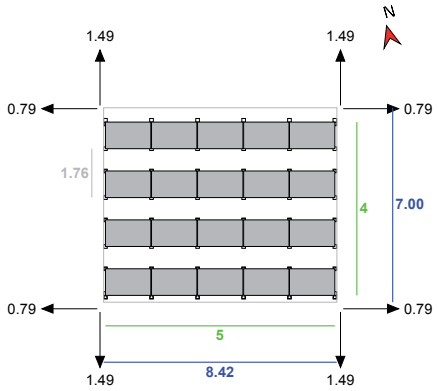
Distance to neighbouring module array [m]

Distance to roof edge [m]

Number of modules

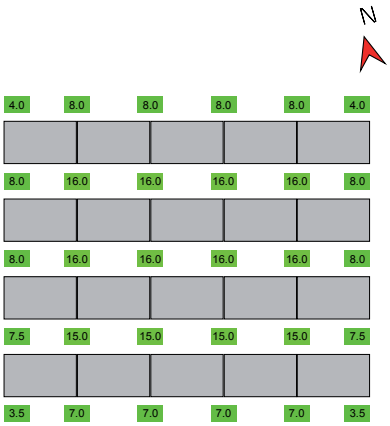
Length/width of module array [m]

Row distance [m]



BALLAST PLAN

1



RESULTS

BALLAST CAPACITY

S-Rock End 15	74.0 kg	Rounding value	0.0 kg
S-Rock Front 15	12.0 kg		
S-Rock 15	68.0 kg		
T-Tray	85.0 kg		

VERIFICATION SYSTEM UTILISATION

		Corner areas North	Corner areas South
Verification system utilisation [%]	**pressure**	362.50	361.10
	suction	22.22	22.91
Loads on modules [kN/m²]	**pressure**	9.50	9.46
	suction	-0.25	-0.15

SPECIFIC LOADS

Index (module block)	No. of modules (module block)	Ballast [kg] (module block)	Dead weight [kg] (module block)	Dead Weight [kN/m²]) (module block)	Dead Weight [kN/m²] (roof surface area)
module array 1	20	310.0	752.0	0.13	---
all Blocks	**20**	**310.0**	**752.0**	---	**0.07**

NOTES

- The ballast calculation was carried out according the Expert's Report 'S-Rock' from 30th Nov 2015.
- The design rules comply with the Eurocode EN 1990 - Basis of structural design.
- Service life is recognised according to 'DIN EN 1991 - Action on structures, Snow loads' and 'DIN EN 1991 - Actions on structures, Wind actions'. Subject to the Building Regulations and for security-relevant reasons the installation has to be dismantled at the end of its service life.
- Failure consequence class is considered according to 'DIN EN 1990 - Basis of structural design'.

STRUCTURAL ANALYSIS REPORT

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Roof pitch	0 °
Edge distance	0.70 m
Friction coefficient	0.30
Terrain category	III: Villages, suburbs, woodlands

LOADS

Design method	Eurocode		
Failure consequence class (CC)	CC1	Service life	25 years

Wind speed	v_b = 15.0 m/s
Peak velocity pressure	$q_{p,50}$= 0.23 kN/m²
Adjustment factor for service life	f_w = 0.903
Peak velocity pressure	$q_{p,25}$= 0.21 kN/m²

Environment	Normal terrain
Snow load on ground level	s_k = 10.00 kN/m²
Shape Coefficient for Snow	μ_i = 0.800
Snow load on roof	$s_{i,50}$ = 8.00 kN/m²
Adjustment factor for service life	f_s = 0.929
Snow load on roof	$s_{i,25}$

= 7.43 kN/m²

DEAD WEIGHT

Weight module	G_M	= 18.5 kg	Dead weight module	= 11.37 kg/m²
Weight mounting system		= 3.6 kg	Dead weight mounting system	= 2.21 kg/m²
Module area	A_M	= 1.63 m²	Dead Weight	= 0.13 kN/m²

LOAD COMBINATIONS

Partial safety factor unfavourable permanent load	$\gamma_{G,sup}$	1.35
Partial safety factor favourable permanent load	$\gamma_{G,inf}$	1.00
Partial safety factor destabilising permanent load	$\gamma_{G,dst}$	1.10
Partial safety factor stabilising permanent load	$\gamma_{G,stb}$	0.90
Partial safety factor first variable load	γ_{Q1}	1.50
Partial safety factor variable loads	γ_{Qn}	1.50
Partial safety factor exceptional load	γ_A	1.00
Combination coefficient with regards to wind	$\psi_{0,W}$	0.60
Combination coefficient with regards to Snow	$\psi_{0,S}$	0.50
Combination coefficient with regards to wind (additional varying influences)	$\psi_{1,W}$	0.20
Importance factor permanent	$\kappa_{FI,G}$	0.90
Importance factor variable	$\kappa_{FI,Q}$	0.85
Importance factor exceptional	$\kappa_{FI,A}$	0.80

Load Combination1:	$E_d = \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * S_{i,n}$
Load Combination2:	$E_d = \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Pressure}$
Load Combination3:	$E_d = \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (W_{k,Pressure} + \psi_{0,S} * S_{i,n})$
Load Combination4:	$E_d = \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (S_{i,n} + \psi_{0,W} * W_{k,Pressure})$
Load Combination5:	$E_d = \kappa_{FI,G} * G_k + \gamma_A * \kappa_{FI,A} * A_d + \kappa_{FI,Q} * \psi_{1,W} * W_{k,Pressure}$
Load Combination6:	$E_d = \gamma_{G,inf} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Suction}$

Uplift Verification:	$E_d = \gamma_{G,stb} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,n,Uplift}$
Displacement verification:	$E_d = \gamma_{G,stb} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,n,Displacement}$

BILL OF MATERIALS

Position	Item no.	Item description	Quantity	Weight
1	2002244	S-Rock 15	18	24.3 kg
2	2002246	S-Rock End 15	6	6.6 kg
3	2002245	S-Rock Front 15	6	4.3 kg
4	2001739	K2 BSP Wing Solar Alu 160x180 18mm	60	21.0 kg
5	2002322	CableRouting Clip	24	0.0 kg
6	2002247	S-Rock Windbreaker 15	20	18.6 kg
7	1005193	Thin sheet screw 6x38	48	0.3 kg
8	2002555	MiniClamp MC 36-50mm	32	3.2 kg
9	2002556	MiniClamp EC 36-50mm	16	1.6 kg
Total				**79.9 kg**