

EXAMPLE



Mounting systems for solar technology



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	D-Dome 2.0
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	0.60 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!

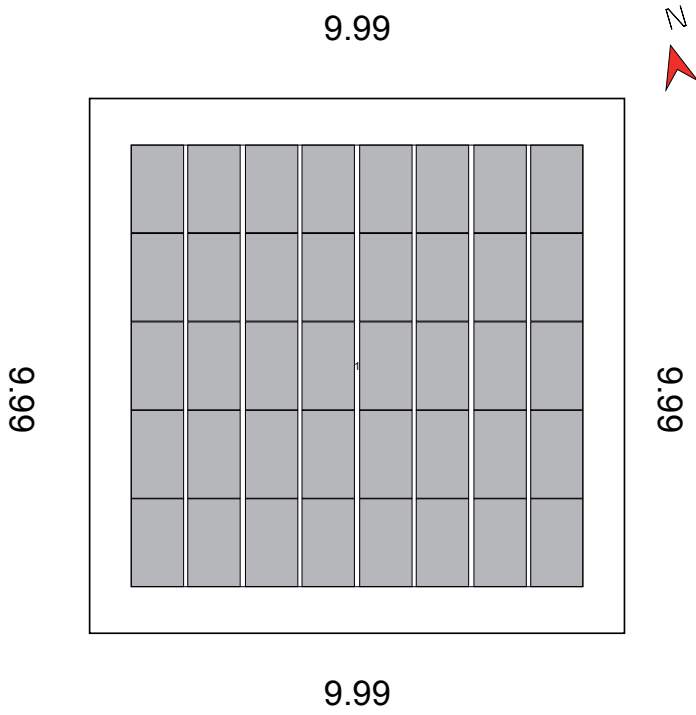
LOADS

Design method	Eurocode		
Failure consequence class (CC)	CC1	Service life	25 years
Peak velocity pressure	$q_{p,25} = 0.21 \text{ kN/m}^2$		
Snow load on ground level	$s_k = 10.00 \text{ kN/m}^2$		

MODULES

Manufacturer	Zonnepaneel	Quantity	40
Name	Benutzerdefiniert	Output power	10 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]

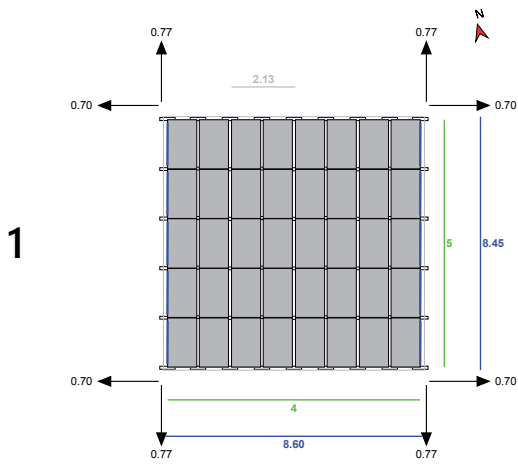
Distance to roof edge [m]

Number of modules

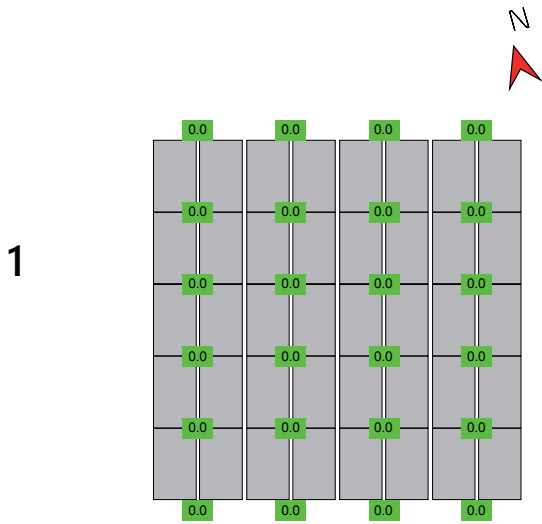
Length/width of module array [m]

Row distance [m]

Installation of base rails in a staggered pattern (re-use of off-cuts)



BALLAST PLAN





RESULTS

BALLAST CAPACITY

Dome	5.0 kg	Rounding value	0.0 kg
Speed Porter	40.0 kg		
Porter	120.0 kg		

VERIFICATION SYSTEM UTILISATION

		Edge
Verification system utilisation [%]	pressure	125.70
	suction	5.97
Loads on modules [kN/m ²]	pressure	9.76
	suction	-0.06

SPECIFIC LOADS

Index (module block)	No. of modules (module block)	Ballast [kg] (module block)	Dead weight [kg] (module block)	Dead Weight [kN/m ²] (module block)	Dead Weight [kN/m ²] (roof surface area)
module array 1	20	0.0	868.0	0.12	---
all Blocks	20	0.0	868.0	---	0.09

NOTES

- 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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LOADS

Design method	Eurocode		
Failure consequence class (CC)	CC1	Service life	25 years
Wind speed	$v_b = 15.0 \text{ m/s}$		
Peak velocity pressure	$q_{p,50} = 0.23 \text{ kN/m}^2$		
Adjustment factor for service life	$f_w = 0.903$		
Peak velocity pressure	$q_{p,25} = 0.21 \text{ kN/m}^2$		
Environment	Normal terrain		
Snow load on ground level	$s_k = 10.00 \text{ kN/m}^2$		
Shape Coefficient for Snow	$\mu_i = 0.800$		
Snow load on roof	$s_{i,50} = 8.00 \text{ kN/m}^2$		
Adjustment factor for service life	$f_s = 0.929$		
Snow load on roof	$s_{i,25}$		



$$= 7.43 \text{ kN/m}^2$$

DEAD WEIGHT

Weight module	$G_M = 18.5 \text{ kg}$	Dead weight module	$= 11.37 \text{ kg/m}^2$
Weight mounting system	$= 3.2 \text{ kg}$	Dead weight mounting system	$= 1.97 \text{ kg/m}^2$
Module area	$A_M = 1.63 \text{ m}^2$	Dead Weight	$= 0.13 \text{ kN/m}^2$

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

BILL OF MATERIALS

Position	Item no.	Item description	Quantity	Weight
1	2001962	Dome D1000 2.0	24	23.7 kg
2	2001968	Dome SD 2.0	48	11.0 kg
3	1001643	M K2 Slot nut with clip, Stainless steel	96	1.7 kg
4	2001729	Hexagonal socket head cap screw DIN 912/EN ISO 4762, M8x20, SER, A2-70	96	1.2 kg
5	2002324	Dome Wire Hanger	48	0.2 kg
6	2001695	K2 BSP Wing Solar Alu 470x180 18mm	54	54.0 kg
7	2001977	SpeedRail 22; 520 mm	54	18.0 kg
8	2000081	K2 Dome Porter	10	14.0 kg
9	2000155	K2 Dome Porter screw SET	6	0.4 kg
10	1004908	K2 Set XS Middle Clamp 39-44mm, 13mm, M8	64	4.5 kg
11	1005170	K2 Set End Clamp 39-41mm	32	2.4 kg
Total				131.1 kg