Technical Submittal - UCLH P5 33695

Package Number:	6000
Package Name:	Mechanical & Electrical
Company Name:	Dornan Engineering
Sub Contractor manager:	James Ryan
File Name:	P5-DES-001-ZZ-TS-E-0048
Document Title:	PV System
Purpose of Issue:	See Conject for current purpose of issue.

Status by Lead Reviewer:	***See Conject for current status***

Version History

Revision No.	Date Issued	Prepared By	Status
P01	23/08/17	Tony McMeiken	For Approval
P02	29/11/17	Tony McMeiken	For Approval
P03	30/10/18	Adrian Conway	For Approval
P04	19/11/18	Adrian Conway	For Approval
P05	24/01/19	Adrian Conway	For Approval

Design Information and Technical Data used to prepare submittal	
Equipment Data Sheets / Schedules **:**	• P5-ARP-Z0-SP-Z-0011 (Section V14) • •
Particular Specification**:**	• P5-ARP-Z0-SP-Z-0004_iss2_revT02 • •
Materials & Workmanship**:**	• • •
Drawings:	• • •
Schematics/Diagrammatic:	• P5-ARP-Z0-ZZ-DR-E-8000_iss2_revT01 • P5-DES-000-ZZ-SC-E-0001 •
Supplementary Specs:	• HTM 06-01 • •

Attachments *(Tick as appropriate)*

- ☑ Catalogue Details
- ☑ Design Check Calculations
- ☑ Manufacturing Drawings
- ☐ Wiring/Control Diagrams
- ☐ Sample List
- ☐ BWIC requirements
- ☐ Assembly / installation details
- ☐ O&M instructions
- ☐ List of recommended spares
- ☐ Interface and coordination with other packages
- ☐ FAT / SAT Test Requirements
- ☐ Description of Operation

Specification Compliance Statement

Technical Submission fully compliant

Y	

If no then proposed deviations are:

Specification Requirement	Proposed Deviation

1 - ARUP SDS

Please refer to next page

ARUP

Electrical Specification Data Sheet
V14 PhotoVoltaic Systems

Job Title: UCLH Phase 5 — Date: 22/01/2016

Job Number: 232426-00 — Purpose of Issue: Tender — Revision: T01

General Data

Reference		Model reference	SOLMATIX RENEWABLES LTD., 13 APEX BUSINESS CENTRE, BEDFORD, LU54SB
Location	Roof	Manufacturer	
Application		Telephone number	
		Fax number	
		Address	
Associated drawings			

This data sheet specifies the materials and workmanship requirements for electrical aspects of PV modules and their installation. It does not cover all the requirements of Building Integrated PV modules. Additional requirements are given in:

Photovoltaics schematic

PV Technology

	Required	Offered	
PV Technology			
Encapsulation method			
Warrented life	25		Years
Building integration method			
PV/Thermal Collector	No		

System Performance

	Required	Offered		
Required output		6245 kWh/year		
Array area available		m²	Refer to	
Shading of cells	None		Refer to	

	Required	Offered
System connection	LV Switchboard	B2 LV SWITCHBOARD
Appearance		
Orientation	South	SOUTHWEST 240°
Tilt	30 degree	10°

The Contractor shall include with their submission, justification of the energy yield declared. This should include details of the model used and assumptions made.

ARUP

Electrical Specification Data Sheet
V14 PhotoVoltaic Systems

Job Title: UCLH Phase 5 Date: 22/01/2016

Job Number: 232426-00 Purpose of Issue: Tender Revision: T01

PV Module - Electrical Data

	Required	Offered			Required	Offered	
Peak Power at STC			Wp	Rated output			kWp
Voltage at Pmax			V dc				

Inverter Details

	Required	Offered
Inverter / Power Conditioning Unit	4 x 4.5kW	1 x 6.3kW

		Required	Offered		Required	Offered	
Inverter Output	Voltage	230	✓	V ac	Frequency	50	✓ Hz
	Phases	1	✓				

Electrical Protection

The requirements given here are intended to clarify the protection requirements of the installation and shall be read in conjunction with the Electrical Schematic and Engineering Recommendations G59 and G83 as appropriate.

	Required	Offered
Overcurrent protection		
Earth fault protection		
Syncronising	Automatic	✓
Overvoltage setting	+10% phase-neutral	✓
Undervoltage setting	-10% phase-neutral	✓
Overfrequency setting	+1%	✓
Undervoltage setting	-6%	✓
Loss of mains protection	ROCOF (frequency shift)	✓
Reverse power		
Method of preventing dc entering ac network	Isolation transformer	✓
Disconnection	By seperation of mechanical contacts. Electronic disconnection not permitted.	✓
Tripping times	<0.5secs	✓
No reconnection for	5 secs	✓
Lockable isolator - ac side of invertor	Yes	✓
- dc side of invertor	Yes	✓
Earthing		

ARUP

Electrical Specification Data Sheet
V14 PhotoVoltaic Systems

Job Title: UCLH Phase 5 Date: 22/01/2016

Job Number: 232426-00 Purpose of Issue: Tender Revision: T01

	Required	Offered			Required	Offered
Fault level from network			kA	Metering	Code 10	✓

Protection systems are to be fully tested and commissioned. For grid connected systems this shall be carried out with a representative of the DNO in attendance.

Load schedule (for off-grid systems)

Electrical Load							Load in VA or Watts	
Ref.	Description	Duration	Qty	VA	Watts	P.F.	Total VA	Total Watts
						Total		

Standards

PV modules shall comply with the following standards where applicable:

PV modules	
Thin film types	IEC 61646
Crystalline types	IEC 61215
Electrical	
General electrical installation	BS7671 & IEC 60364
Installations connected to the distribution network	
Embedded installations to 5MW	Engineering Recommendation G59/4
Embedded installations to 16A/phase	Engineering Recommendation G83/1
Connection agreement	Contractor to liaise & coordinate for connection agreement with PES/DNO
Safety	
Health & Safety	CDM Regulations and Health & Safety at Work Act
Live Working	Avoid live working. If essential, follow HSE Guide 85

Monitoring & Display

	Required	Offered	
Purpose			
Style			
Location		R6 PLANTROOM	
Max dimensions			mm
Minimum information to be displayed			

Job Title: UCLH Phase 5 Date: 22/01/2016

Job Number: 232426-00 Purpose of Issue: Tender Revision: T01

Additional Requirements

1 *These Data Sheets shall be read in conjunction with all relevant sections of the Specification including:*
Technical Preliminaries
Drawings

2 *Tenderers shall complete these Data Sheets, including blank 'data cells', to confirm details of the equipment being 'offered' with the Tender.*

3 *Equipment offered for any alternative Manufacturers shall be equivalent to that offered by the Preferred Manufacturer. Any deviation shall be identified by the Tenderer*

4 *All special tools required for the operation, maintenance and repair of the equipment shall be identified and included in the Tender.*

Additional Project Requirements

2 - CMT Comments and Responses

No.	CMT Comment	Response
1	The proposal do not meet the WIrequirement. The photovoltaic array shallhave approximately 6242 kWh/annum energy output and consist of not less than 32 panelslocated on the roof of the development above 6th Floor plantrooms.	32 panels are not reqiuired to achieve an output of 6242 kWh/annum. There is also limited space to allow for any more than 21 panels which currently have an expected output of 6245kWh/annum.
2	PV panel fixing shall not damage any roof top water proofing.	Ballast system, no penetrations. Technical data sheet included on tech sub.
3	The fixing detail shall agree with architect.	No fixings to roof structure, panels self-weighted.
4	Please confirm the PV system relay and inverter shall be within ICP approved list.	Invertor is G53/9 & G83/2 compliant. See attached certificates below. This falls in line with ICP approved components.
5	PV Panels Steel Supporting Frame at Roof Level shall be accepted by the Structural engineer.	Ballast report attached below for structural engineer's review.
6	Sufficient width of maintenance path shall be indicated on plan when it is submitted.	Already reviewed with man-safe.
7	Cable route / containment and the PV control equipment layout plan shall be submitted for review.	Cable routes will be updated on next revision of containment drawing.
8	Surge Arrestor to protect the PV system shall be provided.	IslaGuard surge arrester will be installed in parallel between inverter and contactor as seen on schematic.
9	The electrical device e.g. distribution board, MCB, fuse, surge arrestor, cables, contactor shall be reffered to approved electrical equipment submission.	All electrical devices and components technical data sheets attached below.

3 - Manufacturers Drawing

UCLH P5 Technical Submittal

Index

1 – Photovoltaic Panel Datasheet

2 – Inverter Datasheet

3 – Framework

4 – Isolator

5 – Energy Meter

6 – PV Layout

7 - Surge Arrester

8 – Electrical Schematic

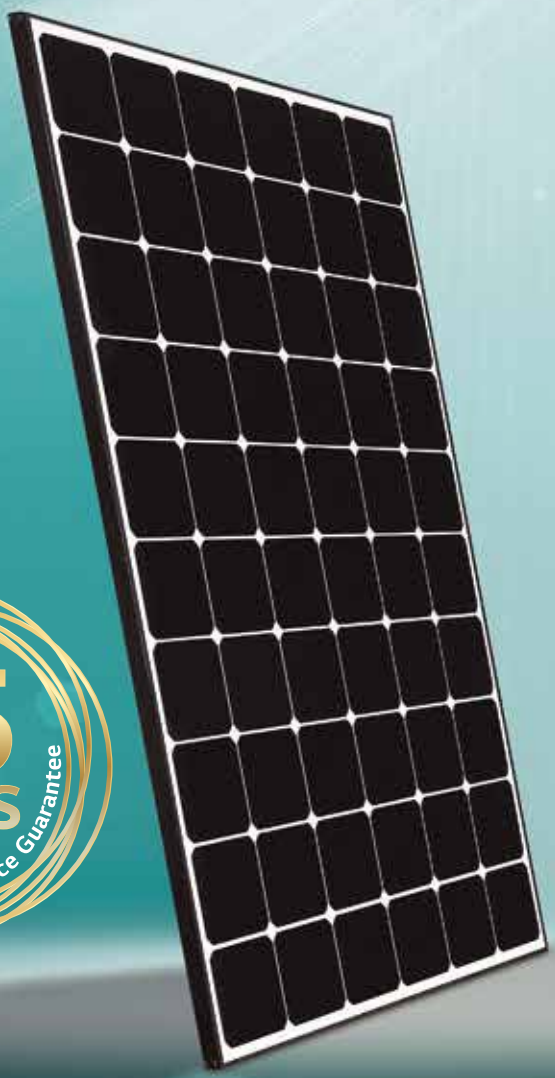
9 – PVSol Report

1 – Photovoltaic Panel Datasheet

EN

THE NEW HIGH PERFORMANCE CHAMPION

LG NeON®R



HIGHLIGHT 2018

UP TO 370 WATTS

CONTACTLESS CELLFRONT

AESTHETIC DESIGN

25 YEARS
LG Product and Performance Guarantee

LG
Life's Good

LG NeON®R
www.lg-solar.com/uk

LG NeON® R

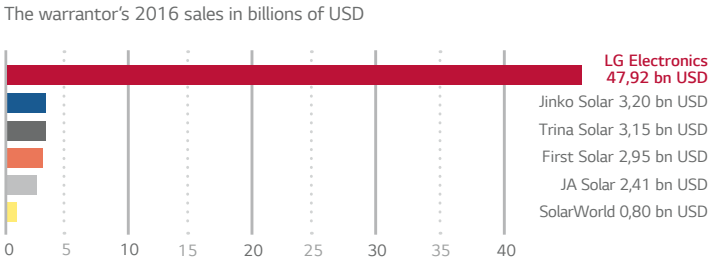
LG NeON® R – PERFORMANCE & DESIGN WITH PASSION

The LG NeON® R is the new high-performance solar module from LG. Its aesthetic design and outstanding performance of up to 370 Wp is a valuable addition to any roof. The 60 cell solar module can endure a static front load up to 6,000Pa, has an expanded product warranty of 25 years and a once-again improved linear performance warranty.

LOCAL GUARANTOR, GLOBAL SECURITY

LG Solar is part of LG Electronics, a global and financially strong company, with over 50 years of experience.

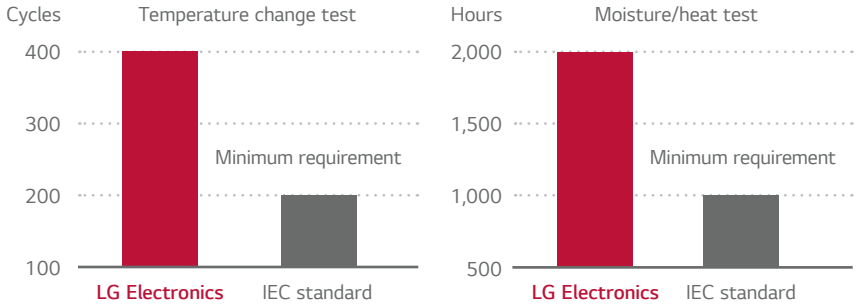
Good to know: LG Electronics is the warrantor for your solar modules.



EXCELLENT QUALITY, INDEPENDENTLY TESTED

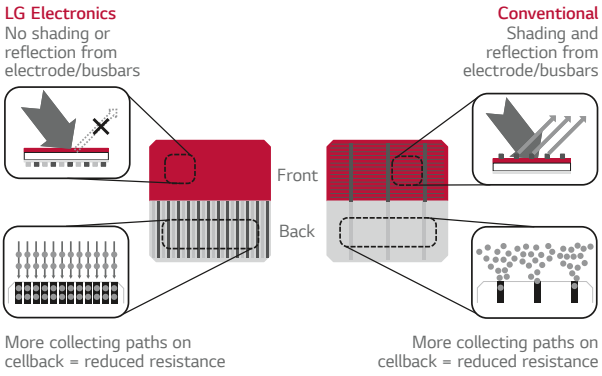
You can rely on LG. We test our products with double the intensity specified in the IEC standard. This quality is valued by installers across Europe, which is why they have awarded our LG solar modules the Top Brand PV stamp of quality for the highest recommendationrates for the fourth time in a row.

EUPD RESEARCH TOP BRAND PV MODULES EUROPE 2018



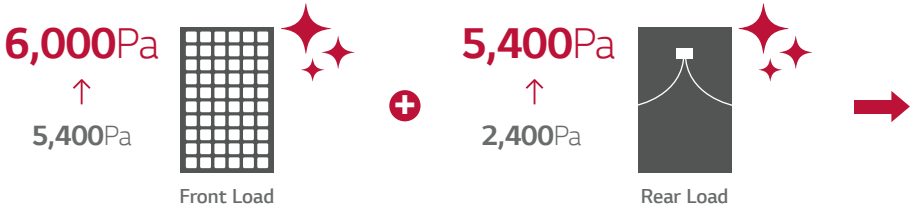
STRONG DESIGN, POWERFUL PERFORMANCE

The busbars on the new LG NeON® R were mounted on the rear of the cells to expose the entire front side to light and therefore generate more electricity. LG creates an innovative and aesthetic cell design by incorporating 30 rear-side busbars instead of the 3 or 4 standard busbars on the cell front, a revolutionary approach that guarantees outstanding module performance.



POWERFUL DESIGN, GUARANTEED ROBUST

With reinforced frame design, LG NeON® R can endure a front load up to 6,000Pa (represents snow height of normal snow of more than 1.8 meters) and a rear load up to 5,400Pa (represents wind speed of up to 93 m/s, compare max. wind speed of Hurricane Katrina 2005 of max. 75 m/s).



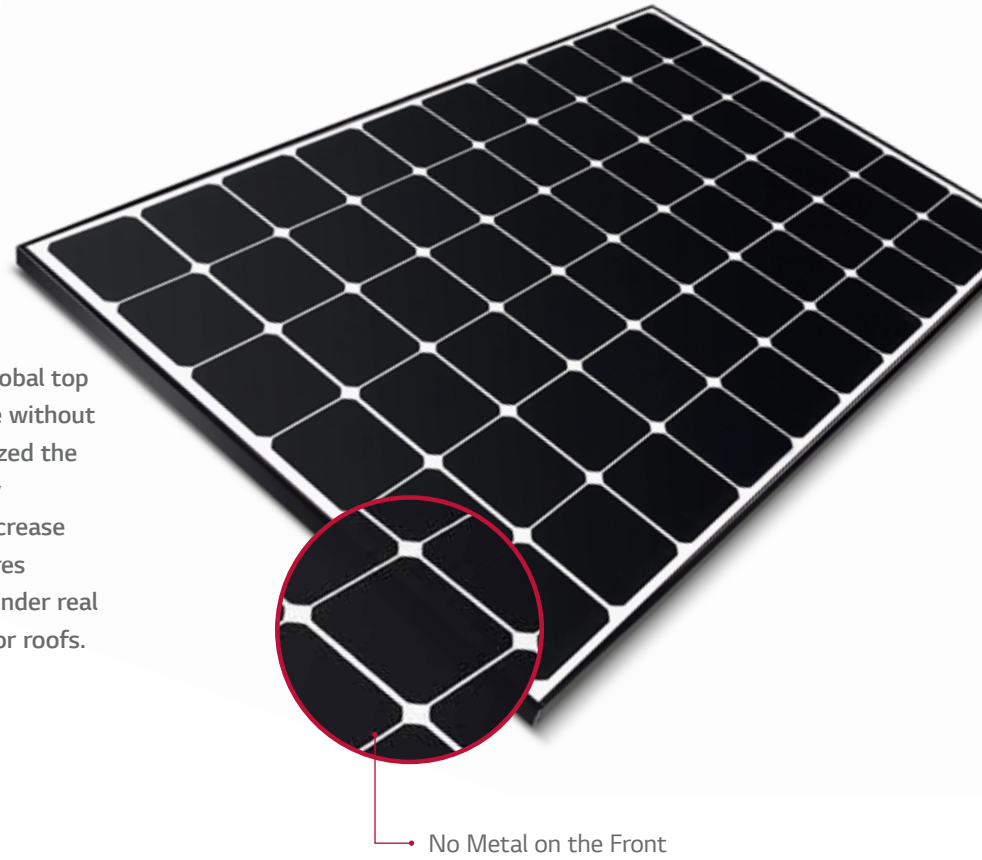
* 1) First year: min. 98 %. 2) From 2nd year: max. 0.4 % annual degradation. 3) 25 years: 88.4 %.

LG NeON® R

LG370Q1C-A5
LG365Q1C-A5
LG360Q1C-A5

60 cell

LG NeON® R is new powerful product with global top level performance. Applied new cell structure without electrodes on the front, LG NeON® R maximized the utilization of light and enhanced its reliability
LG NeON® R demonstrates LG's efforts to increase customer's values beyond efficiency. It features enhanced warranty, durability, performance under real environment, and aesthetic design suitable for roofs.



KEY FEATURES

Enhanced Performance Warranty

LG NeON® R has an enhanced performance warranty. After 25 years, LG NeON® R is guaranteed at least 88.4 % of initial performance.

High Power Output

The LG NeON® R has been designed to significantly enhance its output making it efficient even in limited space.

Aesthetic Roof

LG NeON® R has been designed with aesthetics in mind: no electrode on the front that makes new product more aesthetic. LG NeON® R can increase the value of a property with its modern design.

Outstanding Durability

With its newly reinforced frame design, LG NeON® R can endure a front load up to 6,000Pa, and a rear load up to 5,400Pa.

Better Performance on a Sunny Day

LG NeON® R now performs better on a sunny days thanks to its improved temperature coefficient.

25 Years Product Warranty

As well as the enhanced performance warranty, LG has extended the product warranty of the LG NeON® R from 15 years to 25 years.

About LG Electronics

LG Electronics is a global big player, committed to expanding its operations with the solar market. The company first embarked on a solar energy source research program in 1985, supported by LG Group's vast experience in the semi-conductor, LCD, chemistry and materials industries. In 2010, LG Solar successfully released its first MonoX® series to the market, which is now available in 32 countries. The LG NeON® (previous. MonoX® NeON), NeON®2, NeON®2 BiFacial won the "Intersolar AWARD" in 2013, 2015 and 2016, which demonstrates LG Solar's lead, innovation and commitment to the industry.

LG NeON® R

Mechanical Properties

Cells	6 x 10
Cell Vendor	LG
Cell Type	Monocrystalline / N-type
Cell Dimensions	161.7 x 161.7 mm
# of Busbar	30 (Multi Ribbon Busbar)
Dimensions (L x W x H)	1,700 x 1,016 x 40 mm
Front Load	6,000Pa
Rear Load	5,400Pa
Weight	18.5 kg
Connector Type	MC4, 05-8
Junction Box	IP68 with 3 Bypass Diodes
Cables	1,000 mm x 2 ea
Glass	High Transmission Tempered Glass
Frame	Anodized Aluminium

Electrical Properties (STC[3])

Model		LGXXXQ1C-A5		
Maximum Power (Pmax)	[W]	370	365	360
MPP Voltage (Vmpp)	[V]	37.0	36.7	36.5
MPP Current (Impp)	[A]	10.01	9.95	9.87
Open Circuit Voltage (Voc)	[V]	42.8	42.8	42.7
Short Circuit Current (Isc)	[A]	10.82	10.8	10.79
Module Efficiency	[%]	21.4	21.1	20.8
Operating Temperature	[°C]	-40 ~ +90		
Maximum System Voltage	[V]	1,000		
Maximum Series Fuse Rating	[A]	20		
Power Tolerance	[%]	0 ~ +3		

[3] 1) STC (Standard Test Condition): Irradiance 1,000 W/m², module temperature 25 °C, AM 1.5.
2) The typical change in module effi ciency at 200 W/m² in relation to 1,000 W/m2 is -4.5 %.
3) Application Class: A, Safety Class: II.
4) The nameplate power output is measured and determined by LG Electronics at its sole and absolute discretion.

Certifications and Warranty

Certifications	IEC 61215, IEC 61730-1/-2
	IEC TS 62804-1 (PID)
	IEC 61701 (Salt mist corrosion test)
	IEC 62716 (Ammonia corrosion test)
	ISO 9001
Module Fire Performance	Class C, Fire Class 1 (Italy)[1]
Product Warranty	25 Years
Output Warranty of Pmax	25 years linear warranty[2]

[1] In progress.
[2] 1) First year: min. 98 %. 2) After 2nd year: max. 0.5 % annual degradation. 3) 25 years: min. 88.4 %.

Electrical Properties (NOCT[4])

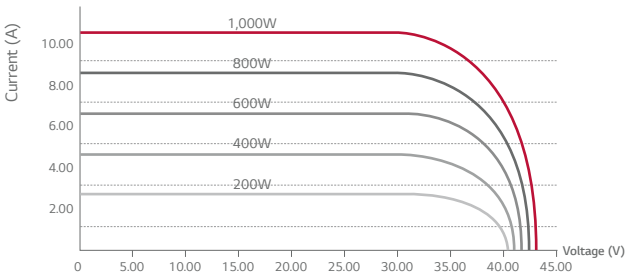
Model		LGXXXQ1C-A5		
Maximum Power (Pmax)	[W]	279	275	271
MPP Voltage (Vmpp)	[V]	36.9	36.6	36.4
MPP Current (Impp)	[A]	7.55	7.51	7.45
Open Circuit Voltage (Voc)	[V]	40.3	40.2	40.2
Short Circuit Current (Isc)	[A]	8.71	8.7	8.69

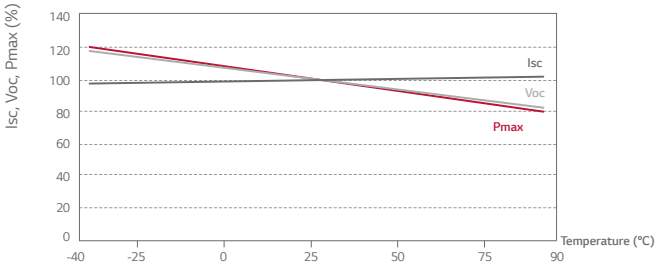
[4] NOCT (Nominal Operating Cell Temperature): Irradiance 800 W/m², ambient temperature 20 °C, wind speed 1 m/s

Temperature Characteristics

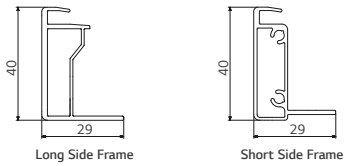
NOCT	[°C]	44 ± 3
Pmax	[%/°C]	-0.30
Voc	[%/°C]	-0.24
Isc	[%/°C]	0.04

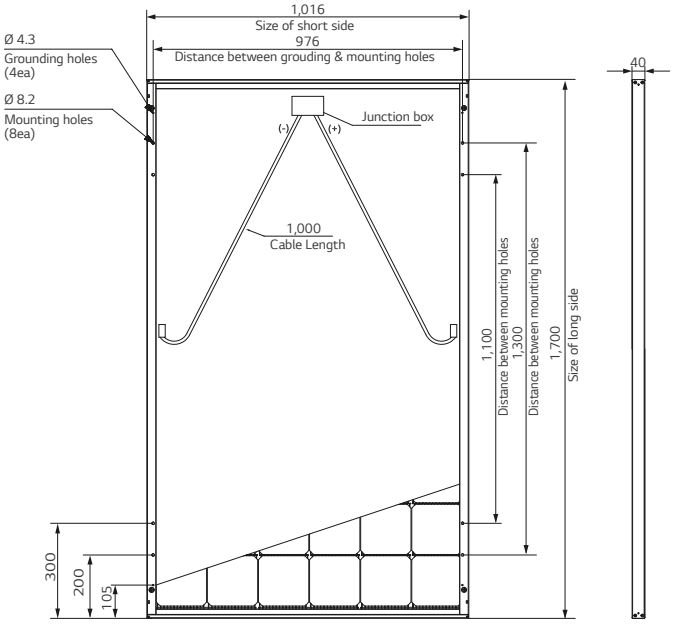
Characteristic Curves





Dimensions (mm)





The distance between the center of the mounting/grounding holes.

LG Electronics Deutschland GmbH
EU Solar Business Group
Alfred-Herrhausen-Allee 3–5
65760 Eschborn, Germany
E-Mail: solar@lge.de
www.lg-solar.com/uk

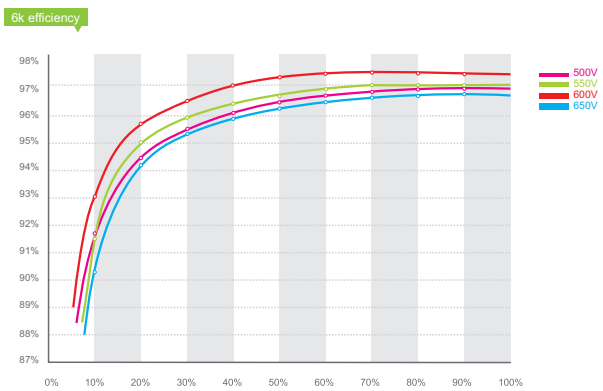
All details in this data sheet comply with DIN EN 50380.
Subject to errors and alterations.
Date: 04/2018
Document: DS-Q1C-A5-EN-201804

2 – Inverter Datasheet

Growatt 4000 UE / 5000 UE / 6000 UE

Leading - edge Technology

- DC input voltage up to 800V
- Maximum efficiency of 97.5%
- Internal DC switch
- Transformerless
- Compact design
- Multi MPP controller
- Ethernet / RF technology / WiFi
- Sound control
- Easy installation
- Comprehensive Growatt warranty program



GROWATT NEW ENERGY TECHNOLOGY Co.,LTD

A: No.28 Guanghui Road, Longteng Community, Shiyan, Baoan District, Shenzhen, P.R.China.

T: + 86 755 2747 1900 F: + 86 755 2749 1460 E: info@ginverter.com

Datasheet

	Growatt 4000 UE	Growatt 5000 UE	Growatt 6000 UE
Input Data			
Max. DC power	4200W	5200W	6300W
Max DC voltage	800V	800V	800V
Start Voltage	150V	150V	150V
PV voltage range	140V - 800V	140V - 800V	140V - 800V
MPP voltage range / nominal voltage	200V - 800V / 580V	200V - 800V / 580V	200V - 800V / 580V
Full load DC voltage range	250V - 750V	300V - 750V	350V - 750V
Number of MPP trackers/strings per MPP tracker	2/1	2/1	2/1
Max. input current/per string	9A / 9A	9A / 9A	10A / 10A
Output (AC)			
Rated AC output power	4000W	5000W	6000W
Max. AC apparent power	4000VA	5000VA	6000VA
Max. output current	6.4A	7.9A	9.3A
AC nominal voltage; range	230V/400V 184 - 275V	230V/400V 184 - 275V	230V/400V 184 - 275V
AC grid frequency; range	50-60Hz; 44-55Hz/54-65Hz	50-60Hz; 44-55Hz/54-65Hz	50-60Hz; 44-55Hz/54-65Hz
Power factor at rated power	1	1	1
Displacement power factor configurable*	0.9 leading -0.9lagging	0.9 leading -0.9lagging	0.9 leading -0.9lagging
THDi (@Full load &THDv<1%)	<3%	<3%	<3%
AC connection	3/N/PE	3/N/PE	3/N/PE
Efficiency			
Max.efficiency	97%	97.4%	97.5%
Euro - eta	95.1%	96.3%	96.5%
MPPT efficiency	99.5%	99.5%	99.5%
Protection Devices			
DC reverse polarity protection	yes	yes	yes
DC switch for each MPPT	yes	yes	yes
Output AC overcurrent protection	yes	yes	yes
Output AC overvoltage protection - varistor	yes	yes	yes
Ground fault monitoring	yes	yes	yes
Grid monitoring	yes	yes	yes
Integrated all-pole sensitive leakage current monitoring unit	yes	yes	yes
General Data			
Dimensions (W / H / D)	433/566/195 mm	433/566/195 mm	433/566/195mm
Weight	30kg	31.1kg	31.1kg
Operating temperature range	-25 °C ... +60 °C	-25 °C ... +60 °C	-25 °C ... +60 °C
Noise emission (typical)	≤35 dB(A)	≤35 dB(A)	≤35 dB(A)
Self-Consumption (night)	< 0.5W	< 0.5W	< 0.5W
Topology	Transformerless	Transformerless	Transformerless
Cooling concept	Natural	Natural	Natural
Environmental Protection Rating	IP 65	IP 65	IP 65
Altitude	2000m without derating	2000m without derating	2000m without derating
Relative Humidity	0~100%	0~100%	0~100%
Features			
DC connection	H4/MC4(opt)	H4/MC4(opt)	H4/MC4(opt)
AC connection	Screw terminal	Screw terminal	Screw terminal
Display	LCD	LCD	LCD
Interfaces: RS232/R485/ Ethernet/RF/WiFi	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt
Warranty:5 years / 10 years	yes / opt	yes / opt	yes / opt
Certificates and Approvals	CE,AS4777,AS/NZS3100,VDE-AR-N4105,VDE0126-1-1,IEC62109,G59/2,EN50438,C10/C11		

*0.95leading...0.95lagging with CEI 0-21 (System power less than 6KW)
0.9leading...0.9lagging with CEI 0-21 (System power less than 6KW)

TYPE TEST SHEET

This Type Test sheet shall be used to record the results of the type testing of Generating unit between 16A per phase and 17KW per phase maximum output at 230V(17KW limit single phase,34KW limit split phase,50KW limit 3 phase)

It include the Generating Units supplier declaration of compliance with requirements of Engineering Recommendation G59/3

Type Tested reference number	Growatt 4000UE/ Growatt 5000UE/ Growatt 6000UE		
Generating unit technology	Photovoltaic inverter		
System Supplier name	Shenzhen Growatt New Energy Co., Ltd		
Address	1st East & 3rd Floor, Jiayu Industrial Zone, Xibianling,Shangwu Village, Shiyan, Baoan District, Shenzhen,P.R.China		
Tel.	+86 755 2951 5888	**Fax**	+86 755 2747 2131
E:mail	info@ginverter.com	**Web site**	www.ginverter.com

Maximum export capacity	**Connection Option**	
	N/A	kW single phase, single, split or three phase system
	4	kW three phase
	5	kW three phase
	6	kW three phase
	N/A	kW two phases split phase system

System supplier declaration.

I certify on behalf of the company named above as a supplier of a Generating unit, that all products supplied by the company with the above Type Test reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G59/3.

Signed	James Wang	**On behalf of**	Shenzhen Growatt New Energy Co., Ltd

Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.

Where parts of the testing are carried out by persons or organizations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

The family product model is made by the following products:

Growatt 4000UE , Growatt 5000UE , Growatt 6000UE

The model Growatt 6000UE is as the representative test models in this report.

Power Quality. Harmonics						
Models: Growatt 6000UE					Harmonic %=Measured Value (Amps) × 23/rating per phase(KVA)	
Generating Unit rating per phase(rpp)			2	KVA		
Harmonic	At45-55% of rated output		100% of rated output		Limit BS EN 61000-3-2	
Average harmonic current results – Phase 1						
	Measured Value (MV) in Amps	**%**	**Measured Value (MV) in Amps**	**%**	**Limit**	**Result**
2	0.005	0.112	0.006	0.069	1.5	PASS
3	0.015	0.345	0.012	0.131	0.7	PASS
4	0.010	0.225	0.008	0.090	5.5	PASS
5	0.121	2.693	0.150	1.688	6.1	PASS
6	0.004	0.098	0.005	0.053	3.6	PASS
7	0.054	1.203	0.091	1.024	14.4	PASS
8	0.005	0.103	0.004	0.046	4.4	PASS
9	0.005	0.107	0.008	0.091	0.8	PASS
10	0.004	0.088	0.003	0.037	1.1	PASS
11	0.012	0.269	0.022	0.250	3.4	PASS
12	0.002	0.054	0.003	0.036	0.2	PASS
13	0.029	0.643	0.007	0.084	24.9	PASS
THD（At 100% rated output）			2.05%			
Average harmonic current results – Phase 2						
	Measured Value (MV) in Amps	**%**	**Measured Value (MV) in Amps**	**%**	**Limit**	**Result**
2	0.007	0.162	0.008	0.090	1.5	PASS
3	0.007	0.150	0.008	0.086	0.7	PASS
4	0.009	0.206	0.007	0.077	5.5	PASS
5	0.126	2.840	0.153	1.750	6.1	PASS
6	0.002	0.038	0.003	0.034	3.6	PASS
7	0.050	1.128	0.084	0.959	14.4	PASS
8	0.004	0.090	0.004	0.045	4.4	PASS
9	0.002	0.053	0.003	0.038	0.8	PASS
10	0.003	0.078	0.003	0.034	1.1	PASS
11	0.013	0.290	0.025	0.284	3.4	PASS
12	0.001	0.026	0.003	0.032	0.2	PASS
13	0.025	0.575	0.006	0.073	24.9	PASS
THD（At 100% rated output）			2.08%			
Average harmonic current results – Phase 3						
	Measured	**%**	**Measured**	**%**	**Limit**	**Result**

	Value (MV) in Amps		Value (MV) in Amps			
2	0.007	0.162	0.008	0.085	1.5	PASS
3	0.025	0.565	0.022	0.251	0.7	PASS
4	0.002	0.044	0.002	0.021	5.5	PASS
5	0.121	2.707	0.149	1.686	6.1	PASS
6	0.004	0.088	0.004	0.043	3.6	PASS
7	0.052	1.165	0.089	1.004	14.4	PASS
8	0.001	0.032	0.001	0.015	4.4	PASS
9	0.008	0.173	0.012	0.135	0.8	PASS
10	0.001	0.028	0.001	0.016	1.1	PASS
11	0.012	0.267	0.023	0.262	3.4	PASS
12	0.002	0.044	0.002	0.026	0.2	PASS
13	0.028	0.623	0.007	0.078	24.9	PASS
THD（At 100% rated output）			2.04%			

Power Quality. Voltage fluctuations and Flicker.					
Models: Growatt 6000UE		**Measured Values at standard impedance**			**Limits set under BS EN 61000-3-2**
		L1	**L2**	**L3**	
Starting	dmax	0.153%	0.162%	0.129%	4%
	dc	0.026%	0.022%	0.029%	3.30%
	d(t)	0.002s	0.002s	0.002s	0.5s
Stopping	dmax	0.173%	0.151%	0.167%	4%
	dc	0.027%	0.025%	0.029%	3.30%
	d(t)	0.002s	0.002s	0.002s	0.5s
Running	Pst	0.165	0.225	0.138	1
	Plt 2	0.073	0.114	0.058	0.65
Test start date		15.10.2015	**Test end date**		15.10.2015
Test location		Growatt R&D Laboratories			

Power quality. DC injection and Power factor.				
Test power level		**DC injection**		
		10%	55%	100%
Test Value	**L1**	13mA	10.1mA	9.2mA
	L2	12.1mA	9.6mA	10.3mA
	L3	14.8mA	12.2mA	10.1mA

Limit(0.25% of rated AC current)	21.7mA	21.7mA	21.7mA
Test power level	Power factor		
	221Vac	230Vac	256Vac
Test Value	0.995	0.996	0.996
Limit	>0.95	>0.95	>0.95

Protection. Frequency tests.						
Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage1	47.53Hz	20.09S	47.53Hz	20.19S	47.73Hz/25s	No Trip
U/F stage2	47Hz	638.2ms	47Hz	749ms	47.2Hz/19.98s	No Trip
					46.8Hz/0.48s	No Trip
O/F stage1	51.47Hz	90.36S	51.48Hz	90.44S	51.27Hz/95s	No Trip
O/F stage2	52Hz	575.7ms	52.01Hz	661ms	51.8Hz/89.98s	No Trip
					52.2Hz/0.48s	No Trip
Note. For frequency Trip tests the Frequency requird to trip is the setting ±0.1Hz. In order to measure the time delay a larger deviation than the minimum required to operate the protection can be used. The "No-trip tests" need to be carried out at the setting ±0.2Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Voltage tests.						
Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage/time	Confirm no trip
U/V stage1	201V	2.6S	200.6V	2.65S	205.1V/3.5s	No Trip
U/V stage2	184.5V	600ms	184.1V	639ms	188.5V/2.48s	No Trip
					180.5V/0.48s	No Trip
O/V stage1	262.2V	1.1S	261.4V	1.12S	258.2V/2.0s	No Trip
O/V stage2	273.7V	600ms	273.1V	633ms	269.7V/0.98s	No Trip
					277.7V/0.48s	No Trip
Note. For Voltage tests the Voltage required to trip is the setting ±3.45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Loss of Mains test						
Test Power and imbalance	33% -5%Q Test 22	66% -5%Q Test 12	100% -5%P Test 5	33% +5%Q Test 31	66% +5%Q Test 21	100% +5%P Test 10

Trip time. Limit is 0.5s	0.285	0.157	0.126	0.264	0.152	0.173

Protection. Frequency change, Stability test.				
	Start Frequency	**Change**	**End Frequency**	**Confirm no trip**
Positive Vector Shift	49.5Hz	+9degrees	--	No trip
Negative Vector Shift	50.5Hz	-9degrees	--	No trip
Positive Frequency drift	49.5Hz	+0.19Hz/sec	51.47Hz	No trip
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.53Hz	No trip

Protection. Re-connection timer.					
Time delay setting	**Measured delay**	**Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1**			
65s	71.5s	At 266.2V	At 197V	At 47.43Hz	At 51.57Hz
Confirmation that the Generating Unit does not re-connect		No reconnection	No reconnection	No reconnection	No reconnection

Fault level contribution.					
For machines with electro-magnetic output			**For Inverter Output**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts**	**Amps**
Peak Short Circuit current	i_p	--	20ms	25.8V	1.03
Initial Value of aperiodic current	A	--	100ms	25.6V	1.12
Initial symmetrical short-circuit current	I_k	--	250ms	25.3V	0.96
Decaying component of short circuit current	i_{DC}	--	500ms	25.3V	0.94
Reactance/Resistance Ratio of source	X/R	--	Time to trip	20ms	In seconds
For rotating machines and linear piston machines the test should produce a 0s-2s plot of the sort circuit current as seen as the Generating Unit terminals					

Type Verification Test Report

Type Approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G83/2.			
SSEG Type reference number		Growatt 6000UE	
SSEG Type		Photovoltaic inverter	
System Supplier name		Shenzhen Growatt New Energy Technology CO ,Ltd	
Address		1st East & 3rd Floor, Jiayu Industrial Zone, Xibianling,Shangwu Village, Shiyan, Baoan District, Shenzhen,P.R.China	
Tel.	+86 755 2951 5888	**Fax**	+86 755 2747 2131
E:mail	info@ginverter.com	**Web site**	www.ginverter.com

Maximum rated capacity, use separate sheet if more than one connection option.	Connection Option	
	N/A	kW single phase, single, split or three phase system
	4	kW three phase
	5	kW three phase
	6	kW three phase
	N/A	kW two phases in three phase system
	N/A	kW two phases split phase system

SSEG manufacturer/supplier declaration.
I certify on behalf of the company named above as a manufacturer/supplier of Small Scale Embedded Generators, that all products manufactured/supplied by the company with the above SSEG Type reference number will be manufactured and tested to ensure that they perform as stated in this Type Verification Test Report, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G83/2.

Signed	James Wang	On behalf of	Shenzhen Growatt New Energy Technology CO ,Ltd

Note that testing can be done by the manufacturer of an individual company, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.
Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

The family product model is made by the following products:
Growatt 4000UE
Growatt 5000UE
Growatt 6000UE
The model Growatt 6000UE is as the representative test models in this report.

Power Quality. Harmonics. The requirement is specified in section 5.4.1, test procedure in Annex A or B 1.4.1				**PASS**
SSEG rating per phase (rpp)		6	kW	NV=MV*3.68/rpp
Harmonic	At 45-55% of rated output	100% of rated output		

Average harmonic current results – Phase 1

	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.067	0.067	0.082	0.082	1.080	
3	0.016	0.016	0.023	0.023	2.300	
4	0.026	0.026	0.035	0.035	0.430	
5	0.072	0.072	0.084	0.084	1.140	
6	0.008	0.008	0.012	0.012	0.300	
7	0.033	0.033	0.057	0.057	0.770	
8	0.004	0.004	0.006	0.006	0.230	
9	0.032	0.032	0.037	0.037	0.400	
10	0.009	0.009	0.012	0.012	0.184	
11	0.093	0.093	0.100	0.100	0.330	
12	0.007	0.007	0.008	0.008	0.153	
13	0.016	0.016	0.022	0.022	0.210	
14	0.005	0.005	0.010	0.010	0.131	
15	0.009	0.009	0.012	0.012	0.150	
16	0.009	0.009	0.012	0.012	0.115	
17	0.022	0.022	0.024	0.024	0.132	
18	0.005	0.005	0.008	0.008	0.102	
19	0.015	0.015	0.022	0.022	0.118	
20	0.004	0.004	0.006	0.006	0.092	
21	0.008	0.008	0.011	0.011	0.107	0.160
22	0.019	0.019	0.041	0.041	0.084	
23	0.020	0.020	0.025	0.025	0.098	0.147
24	0.031	0.031	0.066	0.066	0.077	
25	0.010	0.010	0.012	0.012	0.090	0.135
26	0.005	0.005	0.007	0.007	0.071	
27	0.009	0.009	0.017	0.017	0.083	0.124
28	0.030	0.030	0.065	0.065	0.066	
29	0.008	0.008	0.013	0.013	0.078	0.117
30	0.026	0.026	0.054	0.054	0.061	
31	0.004	0.004	0.007	0.007	0.073	0.109
32	0.003	0.003	0.005	0.005	0.058	
33	0.003	0.003	0.004	0.004	0.068	0.102
34	0.004	0.004	0.007	0.007	0.054	
35	0.005	0.005	0.006	0.006	0.064	0.096
36	0.004	0.004	0.008	0.008	0.051	
37	0.002	0.002	0.003	0.003	0.061	0.091
38	0.002	0.002	0.003	0.003	0.048	
39	0.002	0.002	0.003	0.003	0.058	0.087
40	0.003	0.003	0.004	0.004	0.046	

Average harmonic current results – Phase 2						
	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.020	0.020	0.032	0.032	1.080	
3	0.035	0.035	0.041	0.041	2.300	
4	0.038	0.038	0.042	0.042	0.430	
5	0.079	0.079	0.084	0.084	1.140	
6	0.016	0.016	0.020	0.020	0.300	
7	0.035	0.035	0.057	0.057	0.770	
8	0.011	0.011	0.012	0.012	0.230	
9	0.009	0.009	0.013	0.013	0.400	
10	0.015	0.015	0.017	0.017	0.184	
11	0.093	0.093	0.098	0.098	0.330	
12	0.007	0.007	0.009	0.009	0.153	
13	0.025	0.025	0.030	0.030	0.210	
14	0.008	0.008	0.010	0.010	0.131	
15	0.009	0.009	0.015	0.015	0.150	
16	0.006	0.006	0.010	0.010	0.115	
17	0.027	0.027	0.029	0.029	0.132	
18	0.004	0.004	0.006	0.006	0.102	
19	0.016	0.016	0.021	0.021	0.118	
20	0.003	0.003	0.005	0.005	0.092	
21	0.006	0.006	0.011	0.011	0.107	0.160
22	0.022	0.022	0.046	0.046	0.084	
23	0.013	0.013	0.019	0.019	0.098	0.147
24	0.028	0.028	0.060	0.060	0.077	
25	0.016	0.016	0.018	0.018	0.090	0.135
26	0.006	0.006	0.009	0.009	0.071	
27	0.010	0.010	0.019	0.019	0.083	0.124
28	0.035	0.035	0.076	0.076	0.066	
29	0.009	0.009	0.013	0.013	0.078	0.117
30	0.022	0.022	0.047	0.047	0.061	
31	0.009	0.009	0.011	0.011	0.073	0.109
32	0.003	0.003	0.006	0.006	0.058	
33	0.003	0.003	0.005	0.005	0.068	0.102
34	0.005	0.005	0.009	0.009	0.054	
35	0.006	0.006	0.009	0.009	0.064	0.096
36	0.004	0.004	0.008	0.008	0.051	
37	0.006	0.006	0.008	0.008	0.061	0.091
38	0.003	0.003	0.005	0.005	0.048	
39	0.004	0.004	0.006	0.006	0.058	0.087
40	0.003	0.003	0.005	0.005	0.046	

Average harmonic current results – Phase 3

	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.051	0.051	0.060	0.060	1.080	
3	0.031	0.031	0.036	0.036	2.300	
4	0.036	0.036	0.039	0.039	0.430	
5	0.073	0.073	0.079	0.079	1.140	
6	0.009	0.009	0.012	0.012	0.300	
7	0.025	0.025	0.053	0.053	0.770	
8	0.008	0.008	0.010	0.010	0.230	
9	0.018	0.018	0.024	0.024	0.400	
10	0.008	0.008	0.011	0.011	0.184	
11	0.089	0.089	0.097	0.097	0.330	
12	0.008	0.008	0.011	0.011	0.153	
13	0.011	0.011	0.014	0.014	0.210	
14	0.007	0.007	0.009	0.009	0.131	
15	0.015	0.015	0.018	0.018	0.150	
16	0.007	0.007	0.009	0.009	0.115	
17	0.021	0.021	0.024	0.024	0.132	
18	0.005	0.005	0.008	0.008	0.102	
19	0.009	0.009	0.013	0.013	0.118	
20	0.004	0.004	0.006	0.006	0.092	
21	0.006	0.006	0.008	0.008	0.107	0.160
22	0.018	0.018	0.036	0.036	0.084	
23	0.011	0.011	0.015	0.015	0.098	0.147
24	0.024	0.024	0.050	0.050	0.077	
25	0.010	0.010	0.012	0.012	0.090	0.135
26	0.003	0.003	0.006	0.006	0.071	
27	0.007	0.007	0.011	0.011	0.083	0.124
28	0.026	0.026	0.056	0.056	0.066	
29	0.007	0.007	0.012	0.012	0.078	0.117
30	0.019	0.019	0.042	0.042	0.061	
31	0.007	0.007	0.009	0.009	0.073	0.109
32	0.002	0.002	0.004	0.004	0.058	
33	0.004	0.004	0.006	0.006	0.068	0.102
34	0.003	0.003	0.007	0.007	0.054	
35	0.005	0.005	0.006	0.006	0.064	0.096
36	0.004	0.004	0.007	0.007	0.051	
37	0.004	0.004	0.005	0.005	0.061	0.091
38	0.004	0.004	0.005	0.005	0.048	
39	0.004	0.004	0.005	0.005	0.058	0.087
40	0.003	0.003	0.005	0.005	0.046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

Power Quality. Voltage fluctuations and Flicker. The requirement is specified in section 5.4.2, test procedure in Annex A or B 1.4.3	**PASS**

Growatt 6000UE

	Starting			Stopping			Running	
	d_{max}	d_c	$d_{(t)}$	d_{max}	d_c	$d_{(t)}$	P_{st}	P_{lt} 2 hours
Measured Values	-0.55	1.46	0	-0.50	1.41	0	0.636	0.278
Normalised to standard impedance and 6kW for multiple units	-0.55	1.46	0	-0.50	1.41	0	0.636	0.278
Limits set under BS EN 61000-3-2	4%	3.3%	3.3 % 500ms	4%	3.3 %	3.3 % 500ms	1.0	0.65

Test start date	2013.7.13 3:41:27 PM	Test end date	2013.7.13 4:51:50 PM
Test location	Shenzhen Growatt New Energy Technology CO ,Ltd Research & Development Laboratory		

Power quality. DC injection. The requirement is specified in section 5.5, test procedure in Annex A or B 1.4.4	**PASS**

Growatt 6000UE

Test power level	10%	55%	100%
Recorded value	21.3mA	-15.3mA	10.1mA
as % of rated AC current	0.237%	0.170%	0.112%
Limit	0.25%	0.25%	0.25%

Power Quality. Power factor. The requirement is specified in section 5.6, test procedure in Annex A or B 1.4.2	**PASS**

Growatt 6000UE

	216.2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1.5% of the stated level during the test.
Measured value	0.998	0.999	0.998	
Limit	>0.95	>0.95	>0.95	

Protection. Frequency tests The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.3						**PASS**
Growatt 6000 3ph UE						
Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20s	47.51Hz	20.05s	47.7Hz 25s	No Trip
U/F stage 2	47Hz	0.5s	47.01Hz	0.548s	47.2Hz 19.98s	No Trip
					46.8Hz 0.48s	No Trip
O/F stage 1	51.5Hz	90s	51.50Hz	90.04s	51.3Hz 95s	No Trip
O/F stage 2	52Hz	0.5s	52.00Hz	0.548s	51.8Hz 89.98s	No Trip
					52.2Hz 0.48s	No Trip

Protection. Voltage tests The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.2						**PASS**
Growatt 6000UE						
Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V stage 1	200.1V	2.5s	200.45V	2.582s	204.1V 3.5s	No Trip
U/V stage 2	184V	0.5s	184.5V	0.584s	188V 2.48s	No Trip
					180V 0.48s	No Trip
O/V stage 1	262.2V	1.0s	262.38V	1.062s	258.2V 2.0s	No Trip
O/V stage 2	273.7V	0.5s	273.9V	0.574s	269.7V 0.98s	No Trip
					277.7V 0.48s	No Trip
Note for Voltage tests the Voltage required to trip is the setting ±3.45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Loss of Mains test. The requirement is specified in section 5.3.2, test procedure in Annex A or B 1.3.4						**PASS**
Growatt 6000 UE						
To be carried out at three output power levels with a tolerance of plus or minus 5% in Test Power levels.						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Limit is 0.5 seconds	0.32	0.21	0.16	0.17	0.31	0.25
For Multi phase **SSEG**s confirm that the device shuts down correctly after the removal of a single fuse as well as operation of all phases.						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Ph1 fuse removed	0.21	0.36	0.31	0.25	0.16	0.20
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Ph2 fuse removed	0.22	0.36	0.30	0.26	0.19	0.22
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of SSEG output	95% of SSEG output	95% of SSEG output	105% of SSEG output	105% of SSEG output	105% of SSEG output
Trip time. Ph3 fuse removed	0.20	0.37	0.33	0.25	0.16	0.18
Note for technologies which have a substantial shut down time this can be added to the 0.5 seconds in establishing that the trip occurred in less than 0.5s. Maximum shut down time could therefore be up to 1.0 seconds for these technologies.						

Protection. Frequency change, Stability test The requirement is specified in section 5.3.3, test procedure in Annex A or B 1.3.6				**PASS**
Growatt 6000 3ph UE				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+9 degrees		No Trip
Negative Vector Shift	50.5Hz	- 9 degrees		No Trip
Positive Frequency drift	49.5Hz	+0.19Hz/sec	51.5Hz	No Trip
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.5Hz	No Trip

Protection. Re-connection timer. The requirement is specified in section 5.3.4, test procedure in Annex A or B 1.3.5					**PASS**
Growatt 6000UE					
Test should prove that the reconnection sequence starts after a minimum delay of 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 1.					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
20S	36.21/36.22 36.11/36.21	At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the SSEG does not re-connect.		No Connect	No Connect	No Connect	No Connect

Fault level contribution. The requirement is specified in section 5.7, test procedure in Annex A or B 1.4.6					**PASS**
Growatt 6000UE					
For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	--	20ms	$30V_{r.m.s}$	0.4A
Initial Value of aperiodic current	A	--	100ms	$30V_{r.m.s}$	0
Initial symmetrical short-circuit current*	I_k	--	250ms	$30V_{r.m.s}$	0
Decaying (aperiodic) component of short circuit current*	i_{DC}	--	500ms	$30V_{r.m.s}$	0
Reactance/Resistance Ratio of source*	X/R	--	Time to trip	0.11	In seconds

Self-Monitoring solid state switching The requirement is specified in section 5.3.1, No specified test requirements.	Yes/or NA
Growatt 6000UE	
It has been verified that in the event of the solid state switching device failing to disconnect the SSEG, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 seconds.	Yes

3 – Framework & Ballast System

VAN DER VALK SOLAR SYSTEMS

ValkPro+
ValkFlat - Portrait
ValkFlat - Landscape

Installing solar panels on buildings of any kind is a logical development, as the roof offers free space and often a surface large enough for a profitable additional function. Van der Valk's solar mounting system for flat roofs was developed while taking roof and wind loads into account and, consequently, complies with the most stringent safety requirements.

Our range for flat roof is characterised by great efficiency and ease of assembly. The three south-oriented basic systems described below enable optimal utilization and maximum energy yield for each flat roof.

ValkPro+

Unique to this system:

- ✓ Mounting is faster than ever
- ✓ Metal connectors, no plastic
- ✓ Maximum logistical simplicity
- ✓ Also applicable to high roofs
- ✓ Low ballast due to coupled rows and wind deflectors
- ✓ Smart cablemanagement

ValkFlat - Portrait

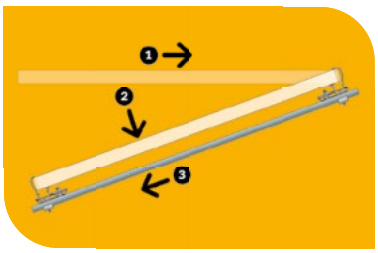
Unique to this system:

- ✓ Clamp system in portrait configuration
- ✓ Any tilt angle possible
- ✓ Universal mid- and end-panel clamps (H 28-50 mm)
- ✓ Quick assembly due to premounted A-frames
- ✓ Low ballast due to coupled design

ValkFlat - Landscape

Unique to this system:

- ✓ Insert system in landscape configuration
- ✓ For extreme wind load
- ✓ Support of the panels on the specified long sides
- ✓ Any tilt angle possible
- ✓ Quick assembly due to premounted A-frames
- ✓ Low ballast due to coupled design



Foundations Flat roof Systems

The **ValkPro+**, the **ValkFlat - Portait** and the **ValkFlat - Landscape** utilize various foundations. For example, the systems can be attached using rubber tile carriers, mass blocks or consoles.

Rubber tile carriers offer ease of transport and installation due to their low weight and raise the system for maximum drainage.

Mass blocks have the advantage that they concurrently provide a significant part of the ballast. In addition, the system is raised higher which offers easy assembly on gravel roofs, for example.

Consoles provide a fixed mounting to the roof in areas with very high wind loads or to roofs that can't tolerate much weight. The special design guarantees watertight sealing.

	ValkPro+	ValkFlat Portrait	ValkFlat Landscape
Rubber tile carriers	✓		
Mass blocks		✓	✓
Consoles	✓	✓	✓

This specifies which foundation can be applied.

Glass panels

As well as the standard solar panels with a frame, solar panels without a frame can also be mounted using glass clamps.

Free Software

With the ValkPVplanner, our free software, a complete calculation, including a list of articles and project-specific installation manual, can be realised in three simple steps.

East west

The systems for flat roofs are also available in east west layout. Please check the seperate leaflet for details.

WHY VAN DER VALK SOLAR SYSTEMS?

- Innovative systems developed in compliance with applicable worldwide standards
- Fast and reliable deliveries thanks to modern machinery and large stocks
- System supplier since 1963
- Free software for project design and project calculation
- All systems applicable to any type of roof or surface
- Quick assembly thanks to premounting of essential components
- All systems available in portrait as well as landscape configuration
- Various systems also available as ready-to-use kits

The mounting systems of Van der Valk Solar Systems are delivered and installed by an extensive network of dealers and installers. We would be happy to help you find your closest point of contact.

For more information (i.e. datasheets, pricelists and manuals) go to the downloads on our website.

Van der Valk Solar Systems develops and produces solar mounting systems for:

Pitched roofs | Flat roofs | Open fields | Greenhouses

VAN DER VALK SOLAR SYSTEMS

V02-2017

PLEASE CONTACT VAN DER VALK SOLAR SYSTEMS, YOUR DEALER OR INSTALLER FOR FULL INFORMATION.

Valk Solar Systems UK Ltd, Innovation House, Discovery Park, Ramsgate Road, Sandwich CT13 9FF, United Kingdom, telephone +44 (0)1304 897658, website www.valksolarsystems.co.uk, e-mail info@valksolarsystems.co.uk **DEVELOPER AND PRODUCER OF SOLAR MOUNTING SYSTEMS.**

Datasheet

Rubber Tile Carrier | Underlay

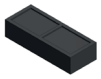
VAN DER VALK SOLAR SYSTEMS

Innovation House, Discovery Park
Ramsgate Road, Sandwich CT13 9FF
United Kingdom
T +44 (0)1304 897658
info@valksolarsystems.co.uk
www.valksolarsystems.co.uk

Material composition

- Recycled rubber granulate bonded with PU binding agent and possibly colouring.

Dimensions

Rubber Tile Carriers				Underlay for PVC roofs	
Article no.	Size (l x w x h)	Application		Article no.	Size (l x w x h)
729625	250 x 75 x 90	ValkPro+		729613	250 x 75 mm
729624	250 x 75 x 90	with PVC for ValkPro+			PVC underlay is already assembled
729627	290 x 115 x 65	Rubber elevation block - gravel roof - ValkPro+		729614	290 x 155 mm
729610	100 x 100 x 10	ValkFlat with mass blocks		729611	250 x 500 mm
729650	250 x 250 x 39	ValkBox 3		729612	250 x 250 mm

Application

- Above items can be used on bitumen and EPDM roofs. On PVC roofs an additional underlay is required.

Colour

- Black
  This colour is not colourfast, and there can be variations in colour as this is a recycled product.

Density

- 800 kg/m³

Fire class

- Efl naar EN 13501

Smoke class

- S2

Dimensional tolerance

- Width 2% and thickness 5%

Colourfastness

- The product is not colourfast, and the colour can fade under the influence of the weather and the foot traffic on the tiles.

Carbon Black

- Carbon black is a black colouring present in every rubber tile which can exude under the influence of the weather.

Lime/cement veil

- Under the influence of the weather and the lime/cement veil of nearby objects, a white efflorescence can appear on the tiles and mats.

Guarantee

- 5-year guarantee on the wear resistance of the product when used for a roof terrace, balcony and gallery. The guarantee does not apply to the colour.

Recycling

- Products are 100% recyclable.

Insulation value

- R_d 0,15 EN13165
  U 3,13 EN 6946

Water permeability

- 565 mm per uur EN 12616

Datasheet

Rubber Tile Carrier | Underlay

VAN DER VALK SOLAR SYSTEMS

Innovation House, Discovery Park
Ramsgate Road, Sandwich CT13 9FF
United Kingdom
T +44 (0)1304 897658
info@valksolarsystems.co.uk
www.valksolarsystems.co.uk

Technical specifications

Specifications rubber	
Material compound	Recycled rubber bounded by polyurethane
Approximate dimensions	250 x 90 x 75 mm
Long term thermal stability	-40°C ... +80°C
Short term thermal stability	up to +110°C
Fire classification	Efl, E(according to EN 13501-1+A1:2010)
Dimension deviation	Max. 1,5% - depending on temperature changes
Color stability	Color may fade out with UV exposure over time
Chemical resistance:	Resistant to weak acids and lyes conditionally resistant to oils

Underlay for PVC roofs

Technical specifications

- Underlay to protect PVC / TPO roof covering
- Material: FLAGON EP/PR 1,04 - 1,144 mm thick
- Synthetic membrane manufactured in TPO modified polyolefin, double colour sand-grey/black, obtained by co-extrusion, reinforced by polyster mesh
- The upper sand grey layer is featured by a very high resistance to weather and UV rays, while the underlying black layer is punching resistant
- Flagon EP / PR has good chemical resistance

Specification table

Specifications underlay		
		FLAGON EP/PR
Thickness	mm	1,04 - 1,144
Weight	kg/m²	0,99 - 1,09
Tensile strength	N/5 cm	≥ 1100
Elongation to break	%	≥ 15
Tear resistance	N	≥ 300
Resistance to impact	mm	≥ 450
Cold bending	°C	≤ -40
Hydrostatic pressure resistance	6 hours at 0,5 Mpa	Waterproof
Dimensional stability	%	≤ 0,5
Resistance to artificial weathering	UV	no surface cracking
Resistance to static punching	kg	≥ 20

ValkPVplanner

Project report

Solmatix
14 Glenwell Road
Antrim
United Kingdom of Great Britain and Northern Ireland
http://www.solmatix.com/

Project name	: UCLH 2
Date (modified)	: 23-01-2019
Time (modified)	: 11:03
Company	: Solmatix
User	: Robin McCullough
Version ValkPVplanner	: 2.5.6

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Index

Overview total project

- Location information / Project overview 03
- Bill of Materials - Total project 04
- Drawing total project 05

Building 1 - Area 1 - Default Subarea 1

- Information | Building 1 - Area 1 - Default Subarea 1 06
- Strength calculations | Building 1 - Area 1 - Default Subarea 1 07
- Bill of Materials | Building 1 - Area 1 - Default Subarea 1 08
- Drawing | Building 1 - Area 1 - Default Subarea 1 09

Regulations 10

Safety instructions | Warranty 12

Location information

Project	: UCLH 2
Project location	: Bloomsbury, London WC1E 6BT, UK
Terrain category	: Town
High neighbouring	: No
Wind area	: 22 m/s
Snow zone	: 0.5 kN/m²
Altitude above sea	: 27 m
Distance to shore line	: 10 km
Distance to edge of the city	: 10 km

Project overview

Building	No. of panels	Power [kWp]	System type	Weight of mounting system [kg]	No. of FULL tiles*	No. of HALF tiles**	Weight of ballast [kg]
Building 1	**21**	**7,56**		**179**	**75**	**5**	**698**
Building 1 - Area 1 - Default Subarea 1	21	7,56	ValkPro+	179	75	5	698

Tiles are included for all flat roof systems selected in this project.

Notes: The results in this project report can be based on default values. Please check if all values are correct.

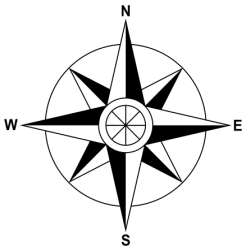
Bill of Materials - Total project

Article no.	Description	Package Qty.	Building 1	Total
729622	Rubber tile carrier - click - ValkPro+	35	43	43
741801500	Galv roof carrier 1500x1,5mm	100	29	29
7506301545G	Tile 30x15x4,5cm - 4,5kg - UK	120	5	5
7506303045G	Tile 30x30x4,5cm - 9kg - UK	60	75	75
774221	Ss hammerhead bolt M8x20mm + lock nut	100	22	22
724650	Alu rear foot ValkPro+ middle	25	13	13
724651	Alu rear foot ValkPro+ side	25	16	16
724660	Alu front foot ValkPro+ middle	25	13	13
724661	Alu front foot ValkPro+ side	25	16	16
742510	Galv back panel ValkPro+ L1780mm	50	21	21
742550	Galv mass carrier ValkPro+ L1779mm	100	0	0
773320	Ss thread-forming bolt M6x20mm - T30	100	29	29
742531	Galv side panel right ValkPro+	100	0	0
742530	Galv side panel left ValkPro+	100	0	0

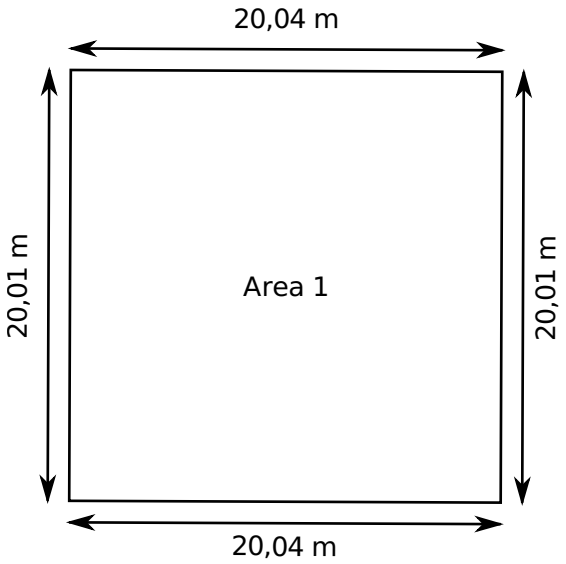
The bill of materials shown on this page, refer to the materials needed for the total project.
The Bill of Materials per individual roof area can be found in the dedicated chapters of this user manual.

Drawing total project

This drawing shows all the buildings of the total project including the different roof areas.



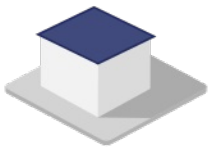
Building 1



Building information

Building name	: Building 1
Gutter height	: 20,00 m

Roof information



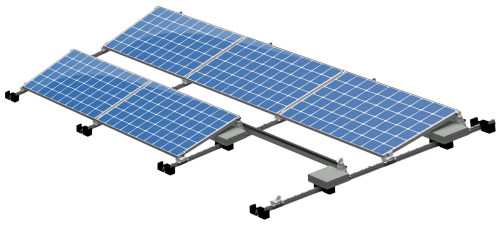
Roof type	: Flat
Roof material	: Sedum
Gravel present	: No

System information

No. of panels south wall	: 21
Module	: LG 360Q1C-A5 1.700 x 1.016 x 0.040
Panel weight	: 19,00 Kg
Module orientation	: Landscape
Edge zone calculated	: 2,00 m
Edge zone adjusted	: 2,00 m
System choice	: ValkPro+
System colour	: Aluminium
Panel inclination	: 10
Azimuth	: 180
Foundation type	: Tile carrier
Include side panel	: No

System type

ValkPro+



Weight information

Weight of panels	:	399,00 kg
Weight of mounting system	:	178,31 kg
Weight of ballast	:	697,50 kg
Total weight	:	1.274,81 kg

System dimension

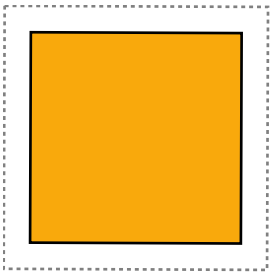
Subarea dimension	:	256,69 m²
System dimension	:	53,90 m²

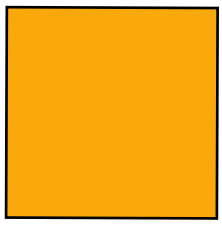
Roof loadings

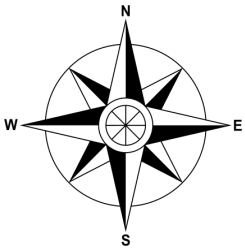
Roof load based on subarea dimension	: 4,97 kg/m² (48,72 N/m²)
Roof load based on system dimension	: 23,65 kg/m² (232,03 N/m²)
Point load max. (max. ballasted points)	: 26 kPa (0,026 N/mm²)
Point load min. (min. ballasted points)	: 18 kPa (0,018 N/mm²)

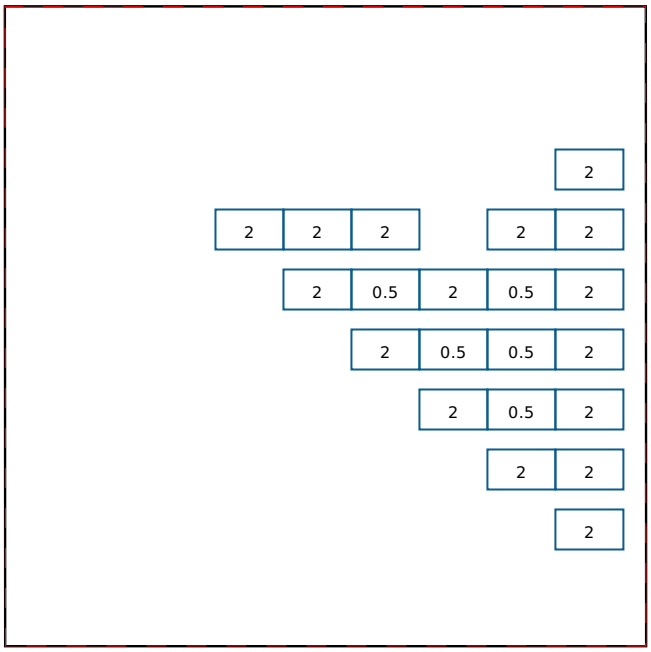
The bill of materials shown in this page apply to materials needed for Building 1 - Area 1 - Default Subarea 1

Article no.	Description	Package Qty.	Calc. Qty.	Extra Qty.	Total Qty.	Total weight
729622	Rubber tile carrier - click - ValkPro+	35	43	0	43	27,52
741801500	Galv roof carrier 1500x1,5mm	100	29	0	29	74,53
7506301545G	Tile 30x15x4,5cm - 4,5kg - UK	120	5	0	5	22,50
7506303045G	Tile 30x30x4,5cm - 9kg - UK	60	75	0	75	675,00
774221	Ss hammerhead bolt M8x20mm + lock nut	100	22	0	22	0,57
724650	Alu rear foot ValkPro+ middle	25	13	0	13	5,37
724651	Alu rear foot ValkPro+ side	25	16	0	16	7,06
724660	Alu front foot ValkPro+ middle	25	13	0	13	3,22
724661	Alu front foot ValkPro+ side	25	16	0	16	4,40
742510	Galv back panel ValkPro+ L1780mm	50	21	0	21	55,46
742550	Galv mass carrier ValkPro+ L1779mm	100	0	0	0	0,00
773320	Ss thread-forming bolt M6x20mm - T30	100	29	0	29	0,17
742531	Galv side panel right ValkPro+	100	0	0	0	0,00
742530	Galv side panel left ValkPro+	100	0	0	0	0,00
Total weight						**875,81 kg**









X	Panels with mass carriers Number represents FULL tiles.	
X	Panels with side panels and mass carriers Number represents FULL tiles.	
X	Panels with side panels Number represents HALF tiles. Use HALF tiles only.	
1 Tile = 30 x 30 x 4,5 cm | 9 kg 0,5 Tile = 30 x 15 x 4,5 | 4,5 kg		

Edge zone calculated: 2,00 m

Edge zone adjusted: 2,00 m

Attention! When placing ballast: work from the outside edge of a row towards the centre. It is possible for one roof carrier in the middle of the row to have no ballast on it.

Regulations

All solar mounting systems of Van der Valk Solar Systems have been designed, calculated and manufactured according to Eurocodes and NEN 7250 regulations and its derivatives (listed below). These regulations have been used for the calculations in the Project Report. Van der Valk Solar Systems meets the applicable CE requirements regarding 2001/95/EG product safety and the applicable sections of BRL9931, components for solar systems. Van der Valk Solar Systems pitched roof clamp systems are MCS012 approved (MCS BBA 0159).

- **EN 1990 Base of Structural design**
  National Annexes:
  - BS EN 1990:2002+A1:2005
  - DIN EN 1990/NA/A1
  - IS-EN 1990:2002+A1:2005
  - NBN EN 1990 ANB
  - NEN-EN 1990+A1+A1/C2/NB
  - NS-EN 1990:2002/NA:2008+A1:2010
  - PN-EN 1990:2004/NA
  - SFS-EN 1990/A1/AC
  - SS-EN 1990/A1:2005/AC:2010
- **EN 1991-1-3 Actions on structures / Snow load**
  National Annexes:
  - BS-EN 1990-1-3:2003
  - DIN EN 1991-1-3/NA
  - IS-EN 1991-1-3:2003
  - NBN EN 1991-1-3 ANB
  - NEN-EN 1991-1-3:2003
  - NS-EN 1991-1-3:2003/NA:2008
  - PN-EN 1991-1-3:2005/NA
  - SFS-EN 1991-1-3/AC
  - SS-EN 1991-1-3/A1:2015
- **EN 1991-1-4 Actions on structures / Wind load**
  National Annexes:
  - BS EN 1991-1-4:2005+A1:2010
  - DIN EN 1991-1-4/NA
  - IS-EN 1991-1-4:2005/NA:2013
  - NBN EN 1991-1-4 ANB
  - NEN-EN 1991-1-4:2005
  - NS-EN 1991-1-4:2005/NA:2009
  - PN-EN 1991-1-4:2008/NA
  - SFS-EN 1991-1-4+AC+A1
  - SS-EN 1991-1-4:2005/AC:2010
- **EN 1993-1-1 Design of steel structures / Rules for buildings**
- **N 1993-1-3 Design of steel structures / Rules for cold formed members**
- **EN 1997 Geotechnical design**
- **EN 1998-1 Design of structures / Seismic actions**
- **EN 1999-1-1 Design of aluminium structures**
- **NEN 7250 Solar systems - Integration in roofs and facades**
- **2001/95/EG Product safety**
- **BRL9931 Components of solar systems**

Wind tunnel testing

Van der Valk Solar Systems have elaborated the results of wind tunnel studies in the product design and calculation tools for both flat and pitched roofs. The application and interpretation of the results have been checked thoroughly and match the assumption and findings as laid down in report W 15328-1ERA-002 dated December 5th, 2016 for flat roofs and WA 15328-!E-RA-002 dated December 22nd, 2016 for pitched roofs.

Default values

- This project report is based on the input and results of the online calculation tool ValkPVplanner. The results derived from this tool were calculated with the greatest possible care. Nonetheless, it is possible that some information might not be entirely correct as the results for each project report can be based on default values. Please check carefully if all values are correct.

Safety instructions

- This ValkPVplanner project report is complementary to the Valk Solar Systems installation manuals, which show how to install the Van der Valk solar mounting system.
- The instructions provided in this ValkPVplanner project report must be observed at all times.
- All structural, safety and building regulations currently applicable must be observed.
- Solar mounting systems installed on roofs can be exposed to wind and snow conditions. This will result in additional pressure load of the installed PV system on the roof and building. A design calculation must be used to establish whether or not the roof and building, will be able to withstand the extra pressure load. Where necessary, modifications need to be made.
- To prevent flat roof systems from moving, lift or tip over, the system needs to be either fixed to the roof or weighed-up by ballast. The ballast calculated in this project report is of critical importance to ensure that the mounting system can be placed and used safely on the roof(s) in subject for this project report.
- Flat roof systems placed on a roof with an inclination of 5 degrees or more must be fixed to the roof.
- Restrictions apply for the position of the solar system on a roof. The solar panels must be placed at a the recommended distance from the roof edge, as shown in this project report.

Warranty

- Standard warranty for pitched roof, flat roof and ground mount systems is 10 years. This can be extended under certain conditions.
- The warranty provided is subject to the warranty conditions stated in the general terms and conditions supplied by Van der Solar Systems BV. Our terms and conditions can be found on our website: www.valksolarsystems.nl.

Disclaimer

- Van der Valk Solar Systems B.V. does not accept any liability for any direct and/or indirect consequences of any act (or omission) ensuing from the information or the failure to observe the instructions provided in this project report and the installation manual, nor for possible incorrect use of the ValkPVplanner by the customer.
- The calculations do not take into account obstacles in the near surrounding like high buildings, cliffs and mountains.
- For the full disclaimer of the ValkPVplanner, please visit our website.: www.valksolarsystems.nl.

Contact

- If you have any questions about the ValkPVplanner, calculation results or this project report: please contact the Van der Valk Solar Systems team.

4 – Isolator

Product Selection

Full Voltage, Non-Reversing Contactors

Frame B

Three-Pole Contactors, Frame B—UL/CSA Ratings

UL General Purpose Ampere Rating	Single-Phase hp Ratings 115V	200V	230V	Three-Phase hp Ratings 200V	230V	460V	575V	Auxiliary Contacts	Screw Terminal Catalog Number ①②
20	1/4	3/4	1	1-1/2	2	3	5	1NO	XTCE007B10_
20	1/4	3/4	1	1-1/2	2	3	5	1NC	XTCE007B01_
20	1/2	1	1-1/2	3	3	5	7-1/2	1NO	XTCE009B10_
20	1/2	1	1-1/2	3	3	5	7-1/2	1NC	XTCE009B01_
20	1	2	2	3	3	10③	10	1NO	XTCE012B10_
20	1	2	2	3	3	10③	10	1NC	XTCE012B01_
20	1	2	3	5	5	10③	10	1NO	XTCE015B10_
20	1	2	3	5	5	10③	10	1NC	XTCE015B01_

Three-Pole Contactors, Frame B—IEC Ratings

AC-3 I_e (A)	AC-1 (40°C) $I_e = I_{th}$ (A)	Maximum kW Ratings AC-3/Three-Phase Motors 50–60 Hz 220/230V	380/400V	415V	660/690V	Auxiliary Contacts	Screw Terminal Catalog Number ①②
7	22	2.2	3	4	3.5	1NO	XTCE007B10_
7	22	2.2	3	4	3.5	1NC	XTCE007B01_
9	22	2.5	4	5.5	4.5	1NO	XTCE009B10_
9	22	2.5	4	5.5	4.5	1NC	XTCE009B01_
12	22	3.5	5.5	7	6.5	1NO	XTCE012B10_
12	22	3.5	5.5	7	6.5	1NC	XTCE012B01_
15.5	22	4	7.5	8	7	1NO	XTCE015B10_
15.5	22	4	7.5	8	7	1NC	XTCE015B01_

Notes

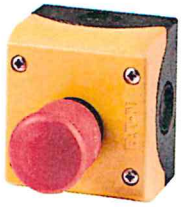
The 7–32A XTCE contactors have positively driven contacts between the integrated auxiliary contact and the auxiliary contact module as well as within the auxiliary contact modules.

DC operated contactors (Frames B–G, 7–150A) have a built-in suppressor circuit.

① Underscore (_) indicates magnet coil suffix required. See **Page V5-T1-53.**

② For spring cage terminals, insert **C** after the fourth digit of the catalog number. Example: XTCE**C**007B10A.
For 7–12A XTCEC contactors, the power, auxiliary and coil terminals are spring cage.
For 18–32A XTCEC contactors, the auxiliary and coil terminals are spring cage.
For 40–150A XTCEC contactors, the coil terminals only are spring cage.

③ For electrical life contactor application data. See **Page V5-T1-45.**



Emergency-stop key-release mushroom, 1N/O+1N/C, surface mounting

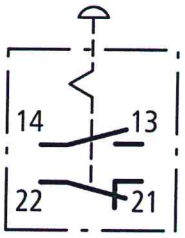
Part no. M22-PV/KC11/IY
Article no. 216525
Catalog No. M22-PV-KC11-IYQ

Powering Business Worldwide

Delivery programme

Approval	BG-Prüfzert 01097; SUVA CNA INSAI; totally insulated
Product range	RMQ-Titan (drilling dimensions 22.5 mm)
Basic function	Emergency stop buttons
Single unit/Complete unit	Complete unit
Description	Tamper-proof according to ISO 13850/EN 418 Pull to release
Colour of enclosure top	Yellow
Colour of enclosure top	
Function	Pull-release

Contacts

N/O = Normally open	1 N/O
N/C = Normally closed	1 NC
Notes	= safety function, by positive opening to IEC/EN 60947-5-1
Contact sequence	

RAL Value	RAL 1004
Front ring	None
Connection to SmartWire-DT	no

Technical data

General

Standards			IEC/EN 60947 VDE 0660
Lifespan, mechanical	Operations	x 10^6	> 0.1
Operating frequency	Operations/h		600
Actuating force		n	50
Degree of Protection			IP66, IP69K
Climatic proofing			Damp heat, constant, to IEC 60068-2-78 Damp heat, cyclic, to IEC 60068-2-30
Ambient temperature		°C	
Open		°C	- 25 - + 70
Mounting position			As required
Mechanical shock resistance		g	50 Shock duration 11 ms

	Sinusoidal according to IEC 60068-2-27

Data for design verification according to IEC/EN 61439

Technical data for design verification

Rated operational current for specified heat dissipation	I_n	A	6
Heat dissipation per pole, current-dependent	P_{vid}	W	0.11
Equipment heat dissipation, current-dependent	P_{vid}	W	0
Static heat dissipation, non-current-dependent	P_{vs}	W	0
Heat dissipation capacity	P_{diss}	W	0

IEC/EN 61439 design verification

10.2 Strength of materials and parts	
10.2.2 Corrosion resistance	Meets the product standard's requirements.
10.2.3.1 Verification of thermal stability of enclosures	Meets the product standard's requirements.
10.2.3.2 Verification of resistance of insulating materials to normal heat	Meets the product standard's requirements.
10.2.3.3 Verification of resistance of insulating materials to abnormal heat and fire due to internal electric effects	Meets the product standard's requirements.
10.2.4 Resistance to ultra-violet (UV) radiation	Please enquire
10.2.5 Lifting	Does not apply, since the entire switchgear needs to be evaluated.
10.2.6 Mechanical impact	Does not apply, since the entire switchgear needs to be evaluated.
10.2.7 Inscriptions	Meets the product standard's requirements.
10.3 Degree of protection of ASSEMBLIES	Does not apply, since the entire switchgear needs to be evaluated.
10.4 Clearances and creepage distances	Meets the product standard's requirements.
10.5 Protection against electric shock	Does not apply, since the entire switchgear needs to be evaluated.
10.6 Incorporation of switching devices and components	Does not apply, since the entire switchgear needs to be evaluated.
10.7 Internal electrical circuits and connections	Is the panel builder's responsibility.
10.8 Connections for external conductors	Is the panel builder's responsibility.
10.9 Insulation properties	
10.9.2 Power-frequency electric strength	Is the panel builder's responsibility.
10.9.3 Impulse withstand voltage	Is the panel builder's responsibility.
10.9.4 Testing of enclosures made of insulating material	Is the panel builder's responsibility.
10.10 Temperature rise	The panel builder is responsible for the temperature rise calculation. Eaton will provide heat dissipation data for the devices.
10.11 Short-circuit rating	Is the panel builder's responsibility. The specifications for the switchgear must be observed.
10.12 Electromagnetic compatibility	Is the panel builder's responsibility. The specifications for the switchgear must be observed.
10.13 Mechanical function	The device meets the requirements, provided the information in the instruction leaflet (IL) is observed.

Technical data ETIM 5.0

Low-voltage industrial components (EG000017) / Control circuit devices combination in enclosure (EC000225)

Electric engineering, automation, process control engineering / Low-voltage switch technology / Command and alarm device / Command and alarm device combination in housing (ecl@ss8-27-37-12-16 [AKF034010])

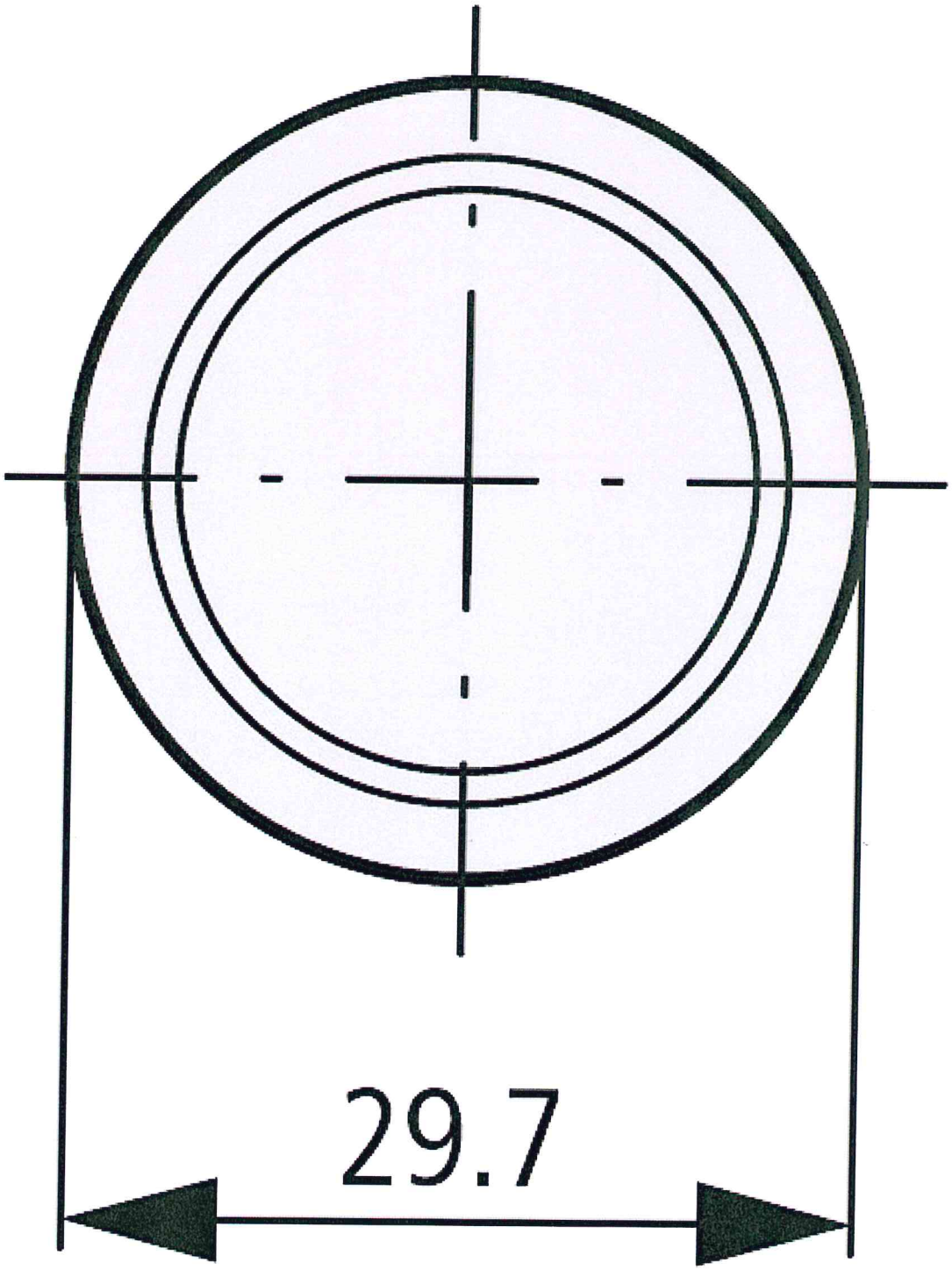
Number of command positions		1
Number of push buttons		1
Number of indicator lights		0
Number of key switches		0
Number of selector switches		0
Number of mushroom-shaped push-buttons		0
Suitable for emergency stop		Yes
Rated control supply voltage Us at AC 50HZ	V	115 - 500
Rated control supply voltage Us at AC 60HZ	V	115 - 500
Rated control supply voltage Us at DC	V	24 - 220
Colour housing cover		Yellow
Material housing		Plastic
Degree of protection (IP)		IP66
Number of contacts as normally open contact		1

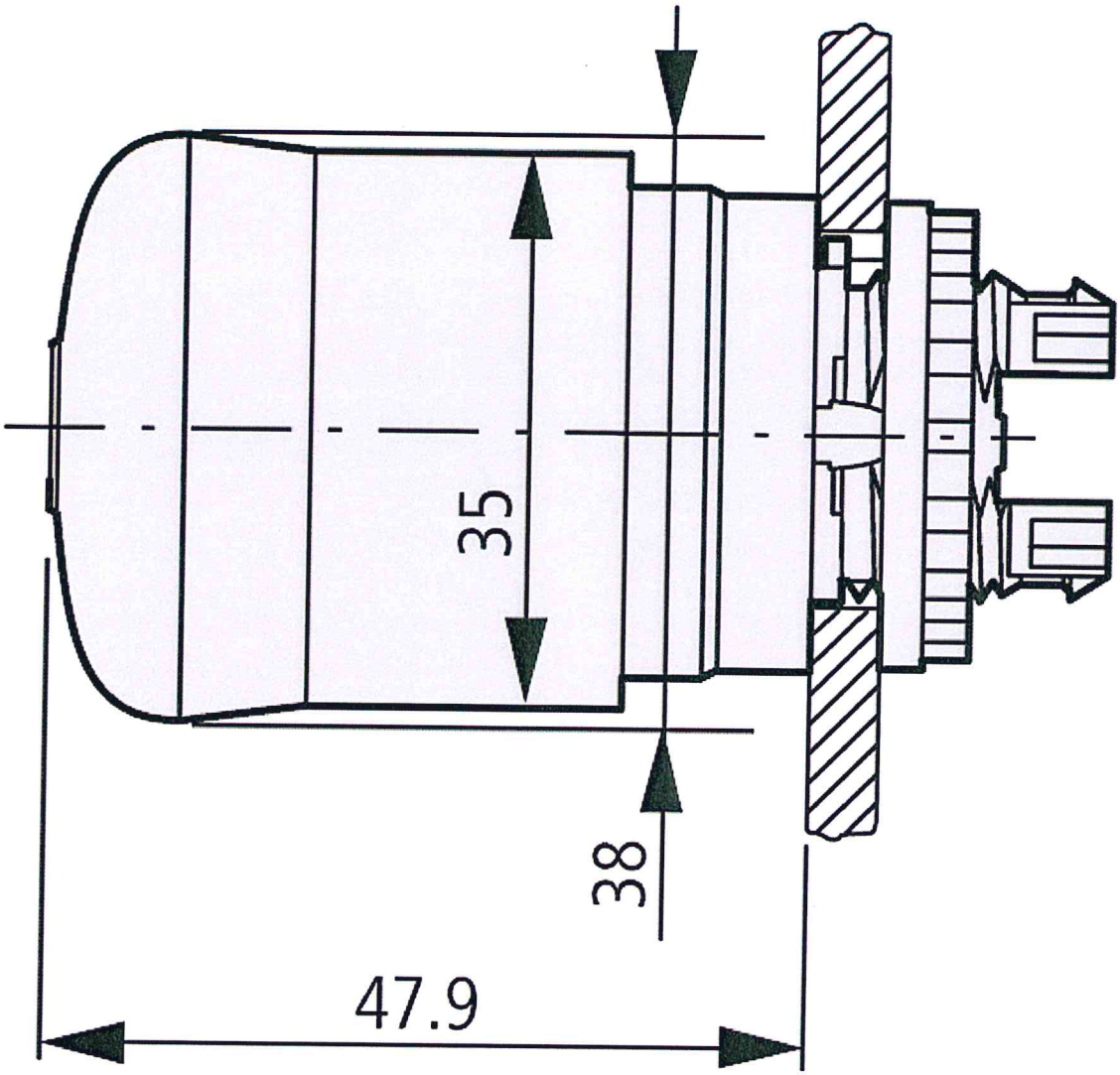
Number of contacts as normally closed contact	1
Number of contacts as change-over contact	0

Approvals

Product Standards	IEC/EN 60947-5; UL 508; CSA-C22.2 No. 14-05; CSA-C22.2 No. 94-91; CE marking
UL File No.	E29184
UL Category Control No.	NKCR
CSA File No.	012528
CSA Class No.	3211-03
North America Certification	UL listed, CSA certified
Degree of Protection	UL/CSA Type 3R, 4X, 12, 13

Dimensions





Additional product information (links)

IL04716002Z (AWA1160-1745) RMQ-Titan System

IL04716002Z (AWA1160-1745) RMQ-Titan System	ftp://ftp.moeller.net/DOCUMENTATION/AWA_INSTRUCTIONS/IL04716002Z2013_08.pdf

Insulated enclosure, HxWxD=200x120x125mm, +mounting rail

Part no. CI-K3-125-TS
Article no. 206884

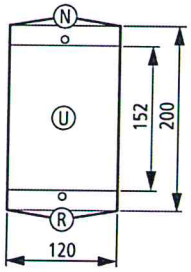
Powering Business Worldwide

Delivery programme

Product range		CI-K small enclosures
Basic function		Basic enclosures
Product function		CI-K empty enclosures
Single unit/Complete unit		Single unit
Degree of Protection		Front IP65 IP65, with push-through cable entry
Degree of Protection		Front IP65 IP65, with push-through cable entry
Material		Glass-fibre reinforced polycarbonate
Colour		Enclosure base RAL 9005, black Operator only RAL 7035, light gray
Description		Metric cable entry knockouts top, bottom and in the back plate Control cable entry Lamp indicator L-... can be mounted in base knock-out M20/M25
Cable entry		hard knockout version

Dimensions

Width	mm	120
Height	mm	200
Depth	mm	125
Dimensions	mm	

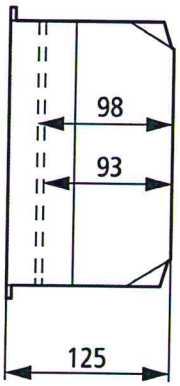


Enclosure depth

Legend for the graphic

Dimensions from top:
Mounting depth with mounting plate
Mounting depth for mounting rail 7.5 mm height
Mounting depth for mounting rail 15 mm height

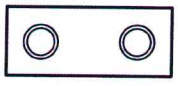
Enclosure depth mm



Mounting depth for mounting rail 7.5 mm height	mm	93
Features		With mounting rail to IEC/EN 60715

Notes

N

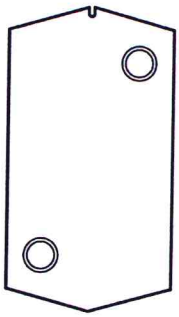


R

Knockouts
2 x M25/20

Knockouts
2 x M25/20
1 x M20

U



Back plate:
2 x M25/20

Technical data

General

Standards		IEC/EN 60529 DIN EN 62208
Climatic proofing		Damp heat, constant, to IEC 60068-2-78 Damp heat, cyclic, to IEC 60068-2-30
Ambient temperature	°C	-25 - +70 -25 - +40 (with push-through cable entry)
Degree of Protection		Front IP65 IP65, with push-through cable entry
Power loss		
Max. radiated heat dissipation with separate mounting, ambient air temperature +20 °C	W	21.5

Material characteristics

Material		
Base		Glass-fibre reinforced polycarbonate
Cover		Glass-fibre reinforced polycarbonate
Surface treatment		Resistant to corrosion
Colour		
Base		RAL 9005, black (matt)
Housing body		Enclosure cover RAL 7035, light grey (matt)

Material properties

Electrical		
Track resistance		CTI 175 (base, to IEC 60112) CTI 175 (cover, to IEC 60112)
Surface resistance to IEC 60093	$\Omega \times 10^{13}$	1
Dielectric strength to IEC 60243-1	kV/mm	30
Thermal		
Temperature resistant		-40 °C - 120 °C (enclosure) -40 °C - +80 °C (gasket)
Mechanical		
Impact resistance		IK06 according to EN 50102
max. assembly weights		
Mounting plate	kg	0.85
Mounting rail	kg	0.85
Chemical resistance		
Chemical resistant		Base, Cover Resistant against: Acids < 10 %, mineral oil, alcohol, gasoline, greases, salt solutions Partly resistant to: Acids > 10 %, alcohol Not resistant to: alkalis, benzene Push-through membrane (CI-K1/CI-K2) and sealing material Resistant against: Acids < 10 %, alkalis, benzene, salt solutions Partly resistant to: Acids > 10 %, greases, benzene Not resistant to: Mineral oil, benzene
Atmospheric		
Saline spray		IEC 60068-2-11
UV resistance		Beneath protective shield

Water consumption to DIN EN ISO 62	%	0.29
Flammability characteristics		
Glow wire test		
Flammability characteristics		960 °C/1mm thickness (base, cover; glow wire to VDE 0471 Part 2) 650 °C/1mm thick (push-through membrane) to VDE 0471 Part 2)
to UL 94		V0/1.5 mm thickness
to UL 94		HB
Halogen free		Yes

Design verification as per IEC/EN 61439

Technical data for design verification		
Operating ambient temperature min.	°C	-25
Operating ambient temperature max.	°C	70
Degree of Protection		Front IP65 IP65, with push-through cable entry
Max. radiated heat dissipation with separate mounting, ambient air temperature +20 °C	W	21.5
Flammability characteristics		960 °C/1mm thickness (base, cover; glow wire to VDE 0471 Part 2) 650 °C/1mm thick (push-through membrane) to VDE 0471 Part 2)
Track resistance		CTI 175 (base, to IEC 60112) CTI 175 (cover, to IEC 60112)
Surface treatment		Resistant to corrosion
Impact resistance		IK06 according to EN 50102
Temperature resistant		-40 °C - 120 °C (enclosure) -40 °C - +80 °C (gasket)
UV resistance		Beneath protective shield
IEC/EN 61439 design verification		
10.2 Strength of materials and parts		
10.2.2 Corrosion resistance		Meets the product standard's requirements.
10.2.3.1 Verification of thermal stability of enclosures		Meets the product standard's requirements.
10.2.3.2 Verification of resistance of insulating materials to normal heat		Meets the product standard's requirements.
10.2.3.3 Verification of resistance of insulating materials to abnormal heat and fire due to internal electric effects		Meets the product standard's requirements.
10.2.4 Resistance to ultra-violet (UV) radiation		Please enquire
10.2.5 Lifting		Not applicable.
10.2.6 Mechanical impact		Does not apply, since the entire switchgear needs to be evaluated.
10.2.7 Inscriptions		Meets the product standard's requirements.
10.3 Degree of protection of ASSEMBLIES		Meets the product standard's requirements.
10.4 Clearances and creepage distances		Meets the product standard's requirements.
10.5 Protection against electric shock		Does not apply, since the entire switchgear needs to be evaluated.
10.6 Incorporation of switching devices and components		Does not apply, since the entire switchgear needs to be evaluated.
10.7 Internal electrical circuits and connections		Is the panel builder's responsibility.
10.8 Connections for external conductors		Is the panel builder's responsibility.
10.9 Insulation properties		
10.9.2 Power-frequency electric strength		Is the panel builder's responsibility.
10.9.3 Impulse withstand voltage		Is the panel builder's responsibility.
10.9.4 Testing of enclosures made of insulating material		Meets the product standard's requirements.
10.10 Temperature rise		The panel builder is responsible for the temperature rise calculation. Eaton will provide heat dissipation data for the devices.
10.11 Short-circuit rating		Is the panel builder's responsibility. The specifications for the switchgear must be observed.
10.12 Electromagnetic compatibility		Is the panel builder's responsibility. The specifications for the switchgear must be observed.
10.13 Mechanical function		The device meets the requirements, provided the information in the instruction leaflet (IL) is observed.

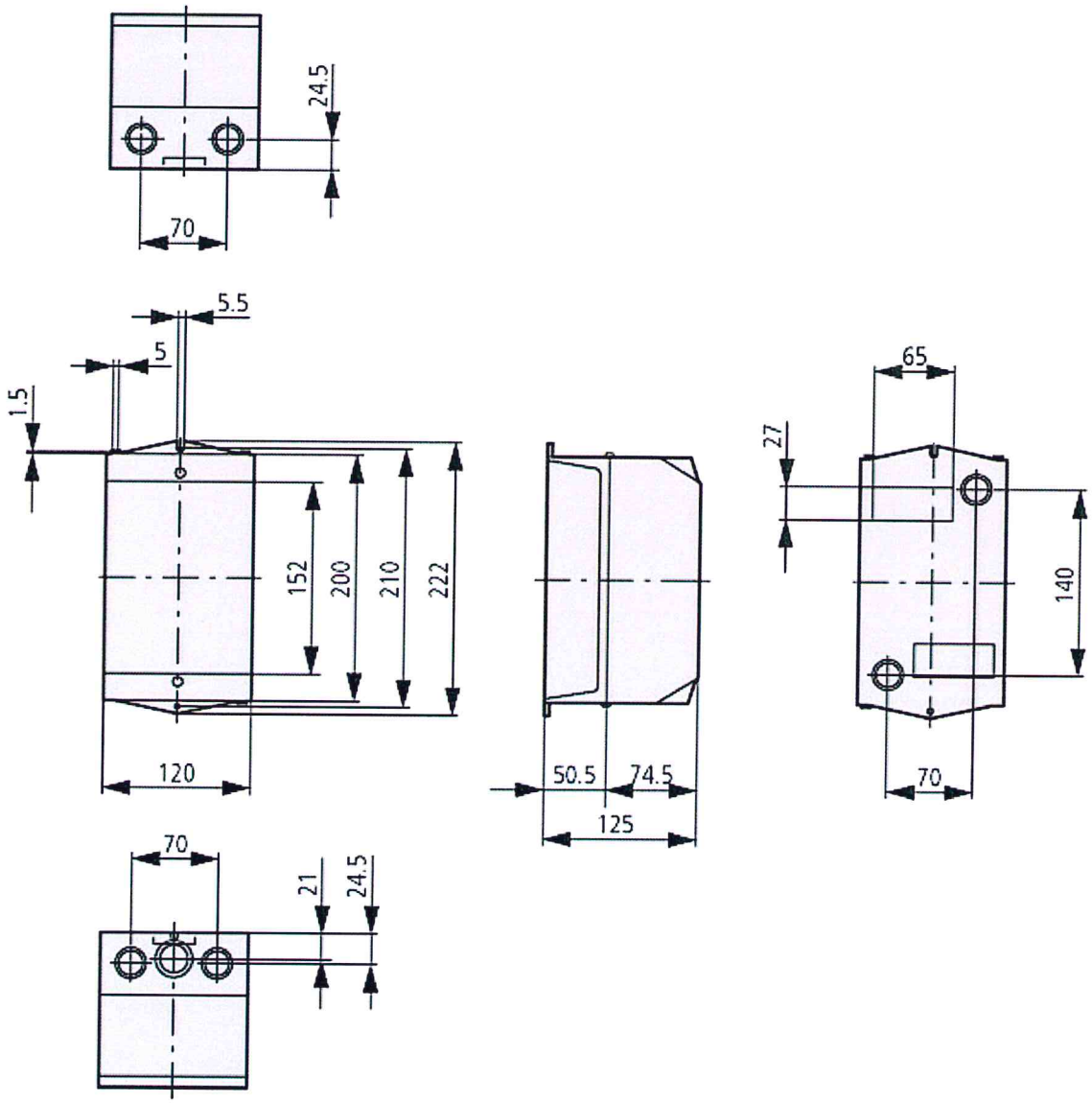
Technical data ETIM 6.0

Low-voltage industrial components (EG000017) / Empty enclosure for switchgear (EC000712)

Electric engineering, automation, process control engineering / Low-voltage switch technology / Component for low-voltage switching technology / Empty housing for switch devices (ecl@ss8.1-27-37-13-01 [AKN343011])

Material housing		Plastic
Width	mm	120
Height	mm	200
Depth	mm	125
With transparent cover		No
Suitable for emergency stop		Yes
Model		Surface mounting
Degree of protection (IP)		IP65

Dimensions



Eaton Industries GmbH
http://www.eaton.eu

206884 - HPL-ED2015 V17.0 EN

5 – Energy Meter

Electricity Meters
Residential

PolyPhase BS Standard Credit Meter

5219

Technical Data

The 5219 is a whole current three phase credit meter, capable of measuring Active (kWh) (class 1.0) and Reactive energy (KVArh) (class 2.0).

Document number: IB057
Date: 05.12.2008
5219 Technical Specification

5219 Technical Specifications

General

Voltage

Nominal Voltage Un	220-240V
Voltage Range	80-115%Un
Voltage Withstand	415V Continuous

Frequency

Nominal Frequency	50/60Hz
Frequency Variation	+/- 2%

IEC-Specific Data

Current

Base Current

Direct Connection Ib	5, 10, 15, 20A

Current Max

Imax	80, 100, 105, 120, 125A

Measurement Accuracy

Measuring Accuracy

IEC 62053-21 Class 1 or 2
IEC 62053-23 Class 2 or 3

Measurement Behaviour

Starting Current

IEC	Class 1 0.4% of Ib Class 2 0.5% of Ib

Max Measuring Range

20mA up to 100A

Approvals

Quality	Manufactured to ISO 9001:2000
Certified Life	20 years
	15 years with Neutral Disconnection Functionality
OFGEM Approval Number	981

Operating Behaviour**

Voltage Interruptions (Power Down)

Blocking of inputs and outputs	Immediate
Standby Operation	for 0.15s
Data Storage after	0.15s
Switch Off	after approx 0.15s

Voltage Restoration (Power Up)

Function Standby (depending on duration of failure)	<5s
Detection of energy direction and phase voltage	<5s

Power Supply Quality

The meter complies with EN63052-11 Section 7.1.1 Voltage range and 7.1.2 Voltage dips and short interruptions

General

Power Consumption

Voltage Circuit	<3W
	<15VA
Current Circuit	<4VA

Environmental Influences

Temperature Test	IEC62053-21, IEC62053-23

Temperature Range

Operation	-10°C to +45°C
Power Measurement Range	-25°C to +55°C
Storage	-25°C to +70°C

This complies with EN 62052-11:2003 section 6.1

Temperature Coefficient

Range	From -10°C to +45°C
Typical mean value	±0.015% per K
	IEC 62053-21
cosφ =1 (from 0.1 Ib to Imax)	±0.05% per K
cosφ=1 (from 02 Ib to Imax)	±0.07% per K
IEC 62053-23	
sinφ =1 (from 0.1 Ib to Imax)	±0.10% per K
sinφ=0.5 (from 02 Ib to Imax)	±0.15% per K
Impermeability to IEC 60529	IP51

Shock Test	BS EN60068-2-27

Electromagnetic Compatibility

Electrostatic Discharges	to IEC 610000-4-2
Contact Discharges	8kV
Air Discharges	15kV
Electromagnetic RF Fields	to IEC 610000-4-3
80 MHz to 2 GHz	at least 10V/m

Radio Interference suppression to IEC/CISPR 22 Class B

Fast Transient burst Test	to IEC 610000-4-4

With basic current Ib:

For current and voltage circuits	4kV
For auxiliary circuits >40V	4kV
With open current circuit for voltage and current circuits	4kV
Fast Transient Surge Test	to IEC 610000-4-5
Impulse Voltage	4kV
Impedance of source	2Ω
Rise/Decay time of impulse voltage	1.2µs/50µs
Rise/Decay time of impulse voltage	8µs/50µs

Case Material

Base, Top Cover and Terminal Cover

Flame retardant and UV stabilised polycarbonate

Communication Interfaces

Optical Interface	
Type	serial, bi-directional interface
Protocol	IEC 62056-21

Insulation Strength

Insulation Strength	4.4kV at 50Hz for 80 seconds
Impulse Voltage Strength	to IEC62053-11
Impulse Voltage	6kV
Impedance of source	500Ω
Rise/Decay time of impulse voltage	1.2µs/50µs

Protection Class II to IEC626050-131 ⧈2

Display

Characteristics	
Type	7 character, 7 segment LCD
Digit size	8x3.5mm
Number of Digits	6 significant numbers 2dp

Weight and Dimensions

Weight	
Standard	950g
With extended terminal cover	1070g

Dimensions	
Width	167.9mm
Height	175.8mm
Depth	56.3mm

Terminal Details	
Arrangement	BS5685
Size	8.3mm diameter

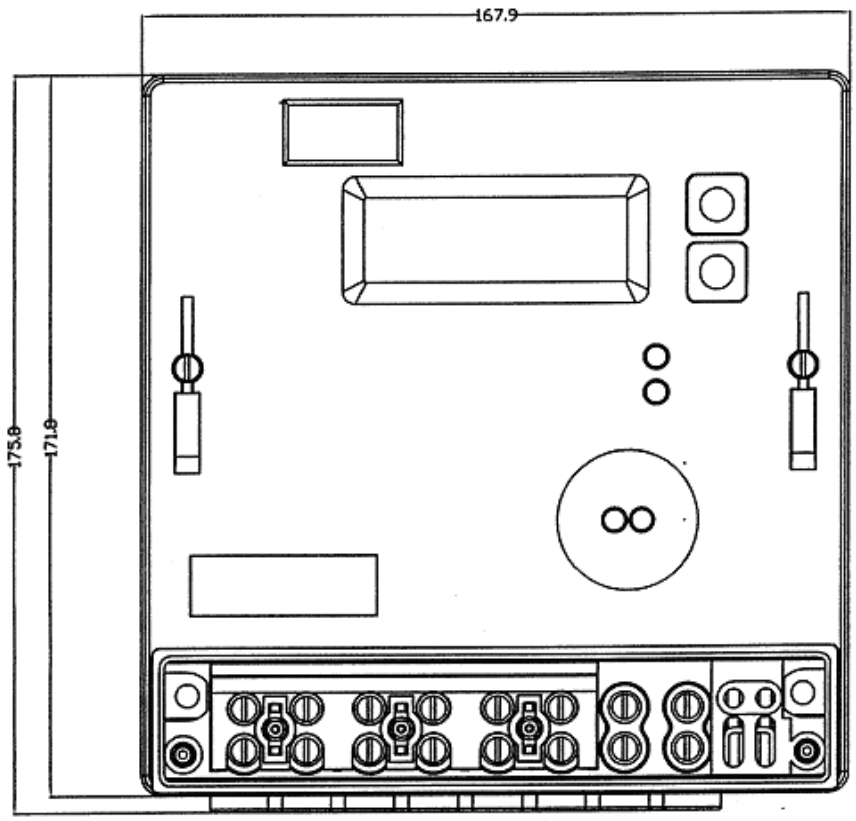
IP Rating

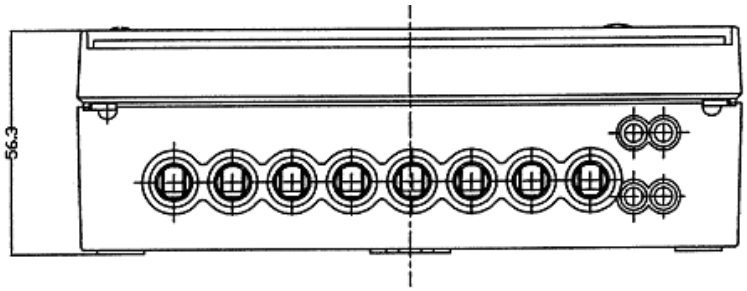
With Short Terminal Cover	IP51
With Extended Terminal Cover	IP54

Connections

Standard Layout and Dimensions

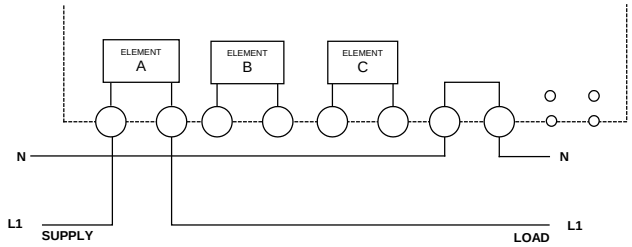
Dimensions



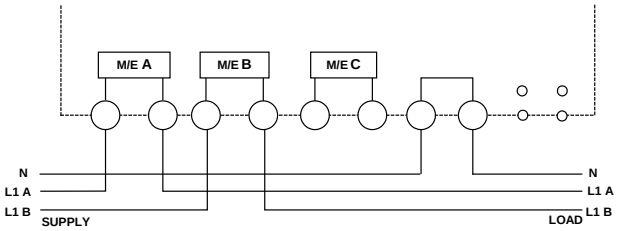


Terminal Connection Diagrams

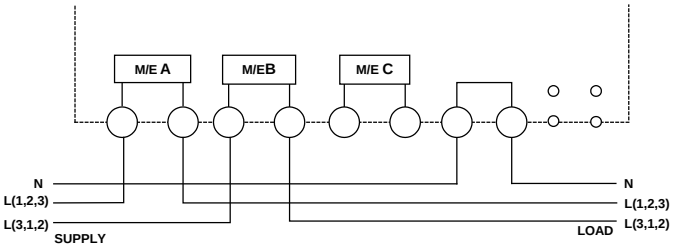
The Meter has 3 measuring elements capable of being configured as:



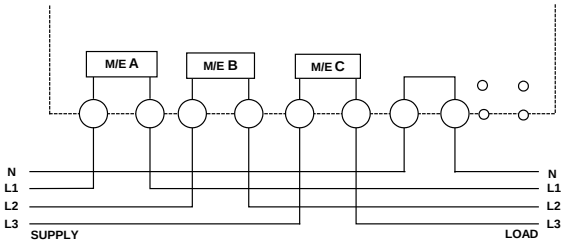
Single Phase 2 Wire



Single Phase 3 Wire



2 Phases of 3 Phase 4 Wire



3 Phase 4 Wire

Landis + Gyr
1 Lysander Drive,
Northfields Industrial Estate,
Market Deeping,
Peterborough
PE6 8FB
www.landisgyr.com

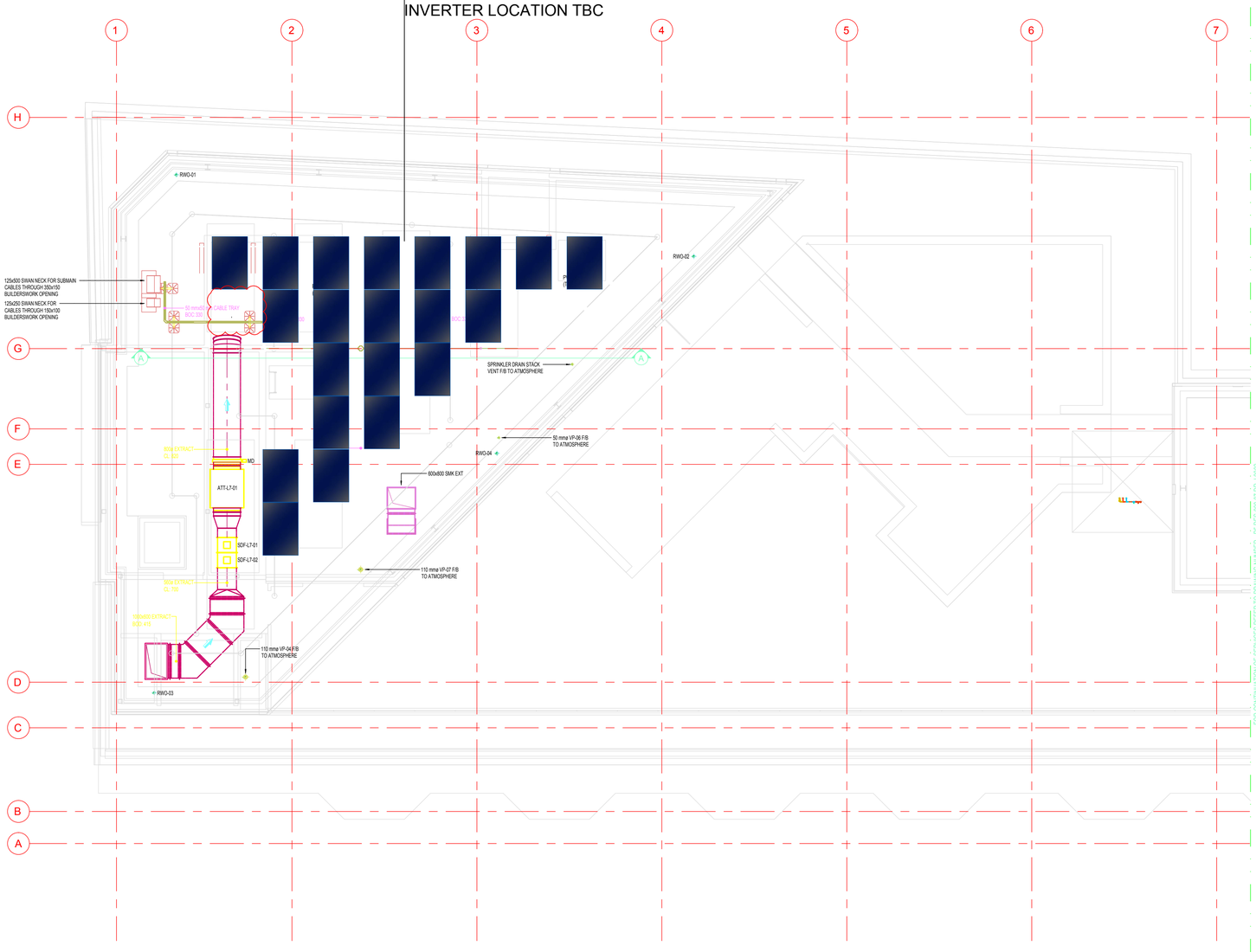
Landis+Gyr
manage energy better

6 – PV Layout

SUNPOWER
360W

VAN DER VALK SOUTH
FACING BALLAST

21NO. 360W SUNPOWER MODULES
MOUNTED TO A 10 DEGREE VDV
BALLAST SYSTEM.
INVERTER LOCATION TBC



LEGEND

- DENOTES PV MODULE
- DENOTES 3 PHASE INVERTER
- DENOTES BALLAST FRAMEWORK
- DENOTES CABLE TRAY

Revision	REVISION HISTORY	DATE
P4	ADD AN ADDITIONAL 2NO MODULES	11/01/18
P3	MODULE MOVED TO ALLOW ROOM FOR HATCH	12/10/18
P2	ONE PANEL REMOVED AND MODULES CHANGED TO 360W	09/10/18
P1	PRELIMINARY DESIGN	05/10/18

solmatix Renewables

PROJECT

UCLH

TITLE

PV DESIGN PROPOSAL
6.84KWP

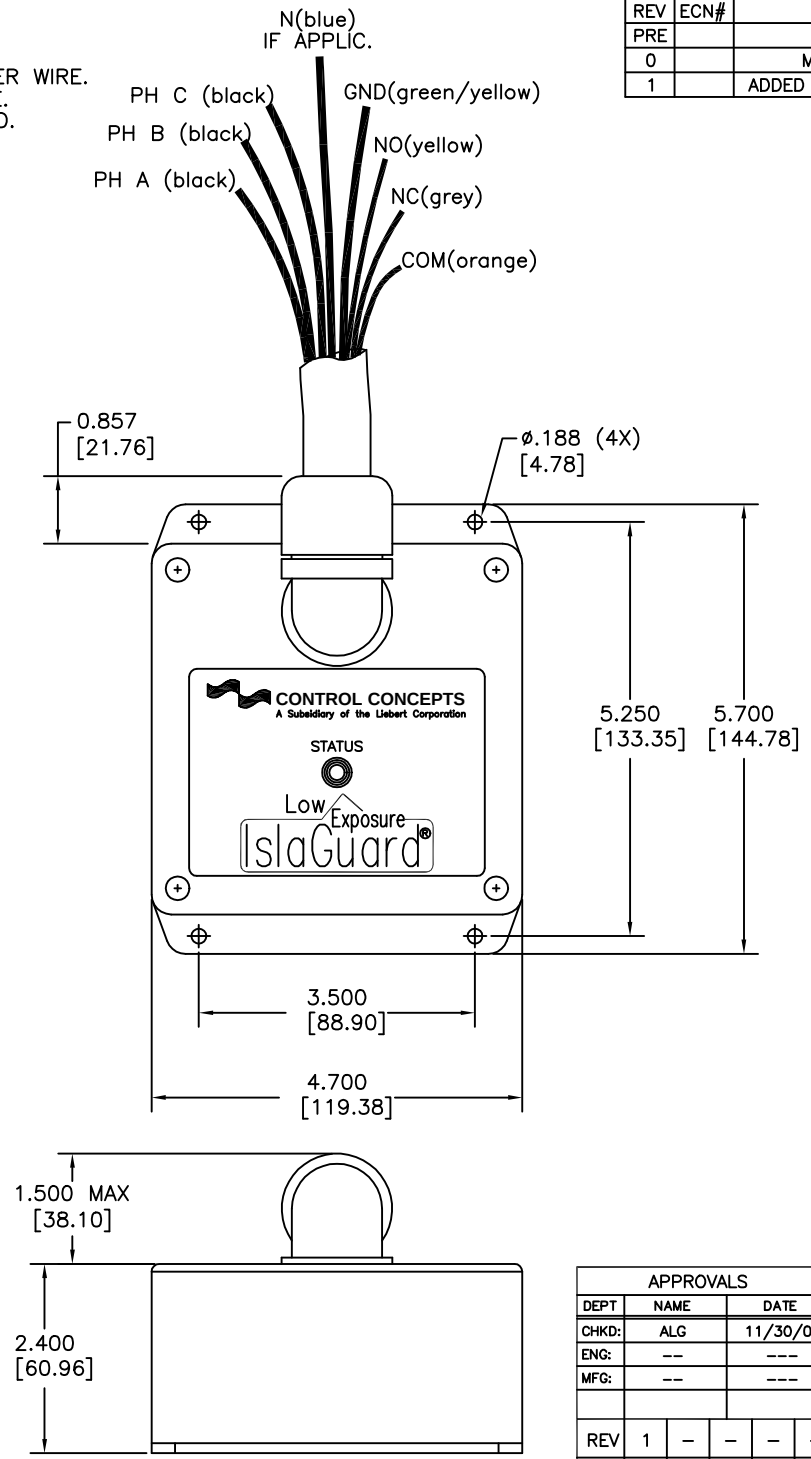
DRAWN BY:	CHECKED:	
SC	SC	
DRAWING NO:	REVISION:	SCALE: NTS
PV001	P4	DATE: 11/01/18

7 - Surge Arrester

NOTES:

1. ENCLOSURE IS MADE OF THERMOPLASTIC NORYL.
2. ALL WIRES 18.50 ± 0.50 OUT OF CASE.
   PHASE A–C, N, GND ARE 12 AWG, 600V, 105°C COPPER WIRE.
   NO, NC, COM ARE 18 AWG, 600V, 105°C COPPER WIRE.
3. 1/2" TRADE SIZE X 9" LG FLEXIBLE CONDUIT PROVIDED.
4. CONDUIT HUB PROVIDED FOR ATTACHMENT TO PANEL.

REVISIONS				
REV	ECN#	DESCRIPTION	DATE	APPR
PRE		PRELIMINARY RELEASE		
0		MANUFACTURING RELEASE		
1		ADDED METRIC & CHG WIRE COLORS		



APPROVALS		
DEPT	NAME	DATE
CHKD:	ALG	11/30/01
ENG:	--	---
MFG:	--	---

REV	1	–	–	–	–
SH	1	2	3	4	5

CONTROL CONCEPTS
A SUBSIDIARY OF THE LIEBERT CORPORATION
328 WATER STREET, BINGHAMTON, NY 13901

CUSTOMER OUTLINE

DATE: 11/30/01	SCALE NONE	TOLERANCE ±.031
DRAWN BY: ALG	MODEL ILxxx–RT	
DRAWING NO.: 82075		SHEET: 1 OF 1

Response Center
P.O. Box 7429, Endicott, NY 13760-7921
Phone (toll free) 877-523-7185 Fax (toll free) 800-233-1074
E-mail: info@control-concepts.com

LOW EXPOSURE SERIES
SINEWAVE TRACKING TVSS

STAGE 3
SMALL MAINS and DISTRIBUTION BOA APPLICATION

Electronic grade surge protective device designed to protect electronic equipment and microprocessor-based systems from transients on sub-distribution panels, branch panels, or equipment located in low exposure locations.

GENERAL TECHNICAL SPECIFICATIONS

Operating Voltage Range	+/- 15%	**Response Time**	< 0.5 ns
Fault Current Rating (AIC)	14 kAIC	**Operating Temperature**	-40°C to +50°C
Operating Frequency Range	47 - 63 Hz	**Operating Humidity**	0% to 95%
Capacity	Continuous	**Certifications**	UL 1449-2 Listed, CUL, CE
50 Ω EMI/RFI Attenuation	40 dB	**Warranty**	5 Year
Dry Contact Rating	125 VAC, 8A, 1.0 pf		

PERFORMANCE TECHNICAL SPECIFICATIONS

Clamping	
UL 1449 Classification*	
120/208	
Line to Neutral	400 Volts
Line to Line	800 Volts
Line to Ground	400 Volts
Neutral to Ground	400 Volts
230/400 MCOV at 320V	
Line to Neutral	800 Volts
Line to Line	1500 Volts
Line to Ground	800 Volts
Neutral to Ground	800 Volts
277/480	
Line to Neutral	800 Volts
Line to Line	1,500 Volts
Line to Ground	800 Volts
Neutral to Ground	800 Volts
480	
Line to Line	1,500 Volts
Line to Ground	1,500 Volts

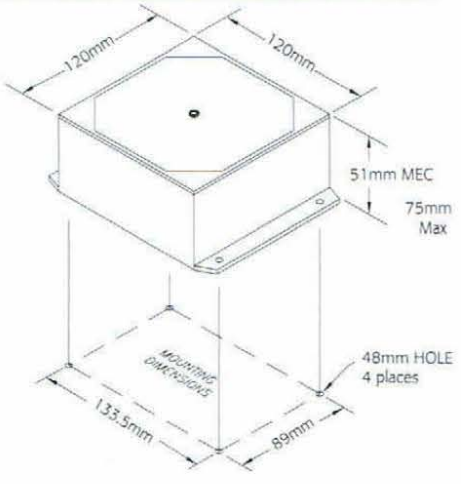
** UL classifications for other voltages available upon request.*

Peak Surge Current Capability (8 x 20 µs)	
Model ILxxxx100WLR	
Phase:	100,000 Amps
L-N:	50,000 Amps
L-L:	50,000 Amps
L-G:	50,000 Amps
N-G:	50,000 Amps
Model ILxxxx50WLR	
Phase:	50,000 Amps
L-N:	25,000 Amps
L-L:	25,000 Amps
L-G:	25,000 Amps
N-G:	25,000 Amps
Model ILxxxx25-2WLR	
Phase:	25,000 Amps
L-N:	25,000 Amps
L-L:	25,000 Amps
L-G:	N/A
N-G:	25,000 Amps

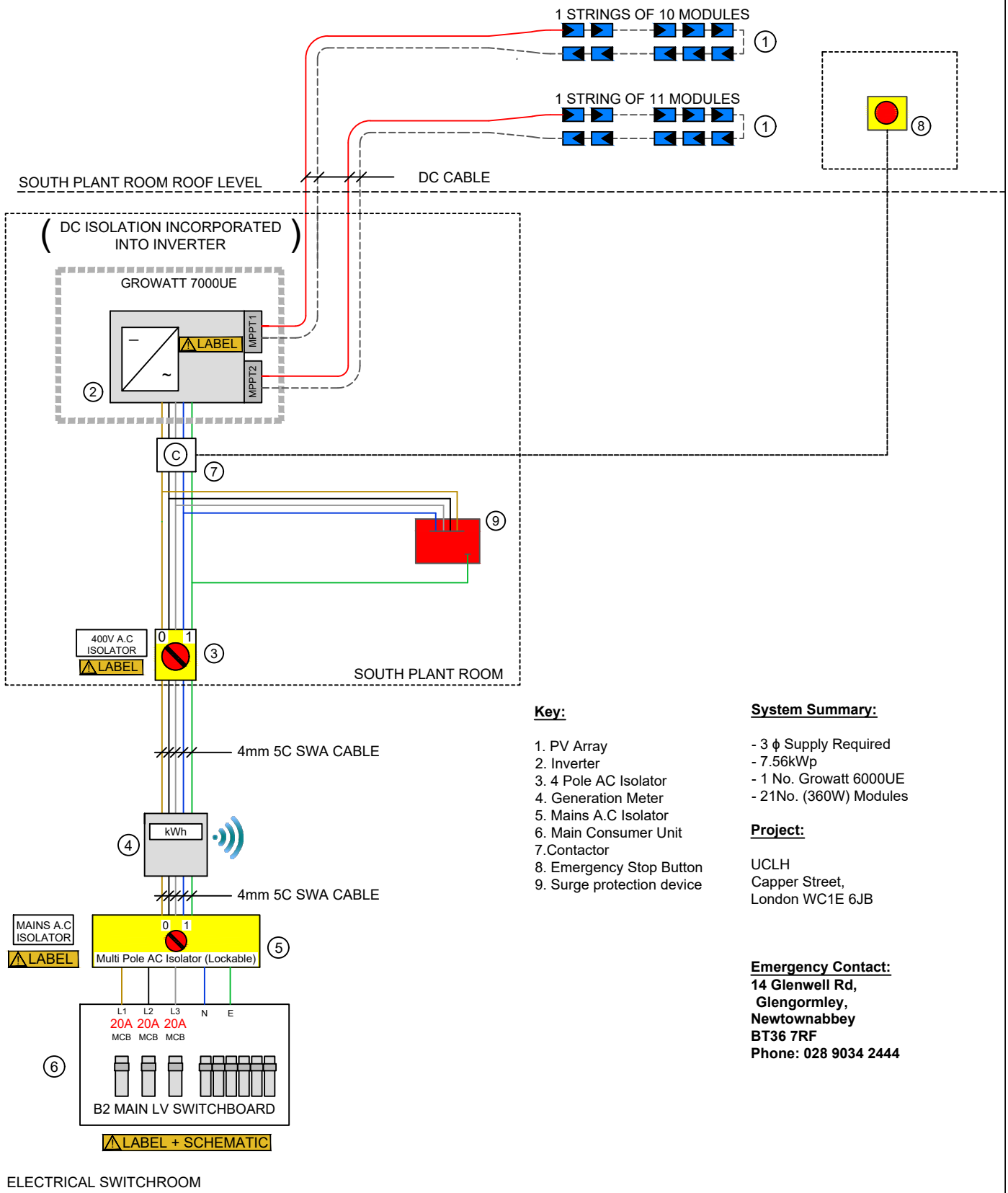
FEATURES

- Surge current capacity — 25,000 to 100,000 Amps per phase
- All mode and 2 mode protection option
- Small footprint
- All voltage and phase configurations
- LED status indication and form C contact for remote indication
- Sand encapsulation
- Thermal protection
- Silver link fusing
- 5 year warranty

DIMENSIONAL DIAGRAM



8 – Electrical Schematic



Key:

1. PV Array
2. Inverter
3. 4 Pole AC Isolator
4. Generation Meter
5. Mains A.C Isolator
6. Main Consumer Unit
7. Contactor
8. Emergency Stop Button
9. Surge protection device

System Summary:

- 3 ϕ Supply Required
- 7.56kWp
- 1 No. Growatt 6000UE
- 21No. (360W) Modules

Project:

UCLH
Capper Street,
London WC1E 6JB

Emergency Contact:

14 Glenwell Rd,
Glengormley,
Newtownabbey
BT36 7RF
Phone: 028 9034 2444

Title: PV Electrical Schematic	
Drawing Ref.: ES001- Electrical Schematic (21 Modules)	
Date Drawn: 09/10/2018	Drawn by: SC

solmatix Renewables

9 – PVSol Report

Company

Solmatix

14 Glenwell Road, Glengormley
BT36 7RF
N.Ireland

Contact Person:
Alan Paul

Phone: 02890824000

E-Mail: alan.paul@solmatix.com

Client

Project

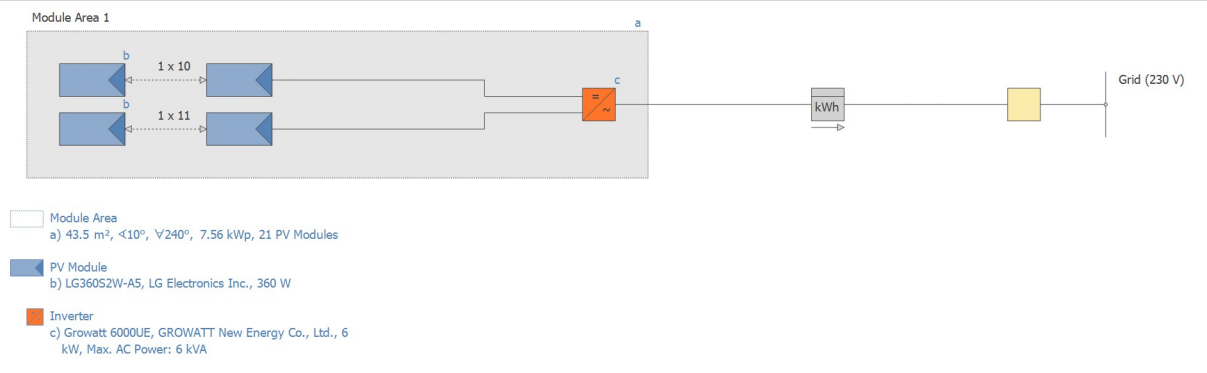
Address:

Start of Operation Date: 19/09/2018

Project Description:
21 x 360W LG Modules

Grid-connected PV System

Climate Data	Camden, GBR (1991 - 2010)	
PV Generator Output	7.56	kWp
PV Generator Surface	43.5	m²
Number of PV Modules	21	
Number of Inverters	1	



The yield

PV Generator Energy (AC grid)	6,245	kWh
Spec. Annual Yield	826.10	kWh/kWp
Performance Ratio (PR)	87.9	%
CO_2 Emissions avoided	3,747	kg / year

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the System

Climate Data	Camden, GBR (1991 - 2010)	
Resolution of the data	1 h	
Type of System	Grid-connected PV System	
Simulation model used		
Diffuse Irradiation onto Horizontal Plane	Hofmann	
Irradiance onto tilted surface	Hay & Davies	

PV Generator Module Area

Name	Module Area 1	
PV Modules*	21 x LG360S2W-A5	
Manufacturer	LG Electronics Inc.	
Inclination	10	°
Orientation	Southwest 240	°
Installation Type	Mounted - Roof	
PV Generator Surface	43.5	m²
Shading	7	%

Inverter

Module Area	**Module Area 1**
Inverter 1*	1 x Growatt 6000UE
Manufacturer	GROWATT New Energy Co., Ltd.
Configuration	MPP 1: 1 x 11 MPP 2: 1 x 10

AC Mains

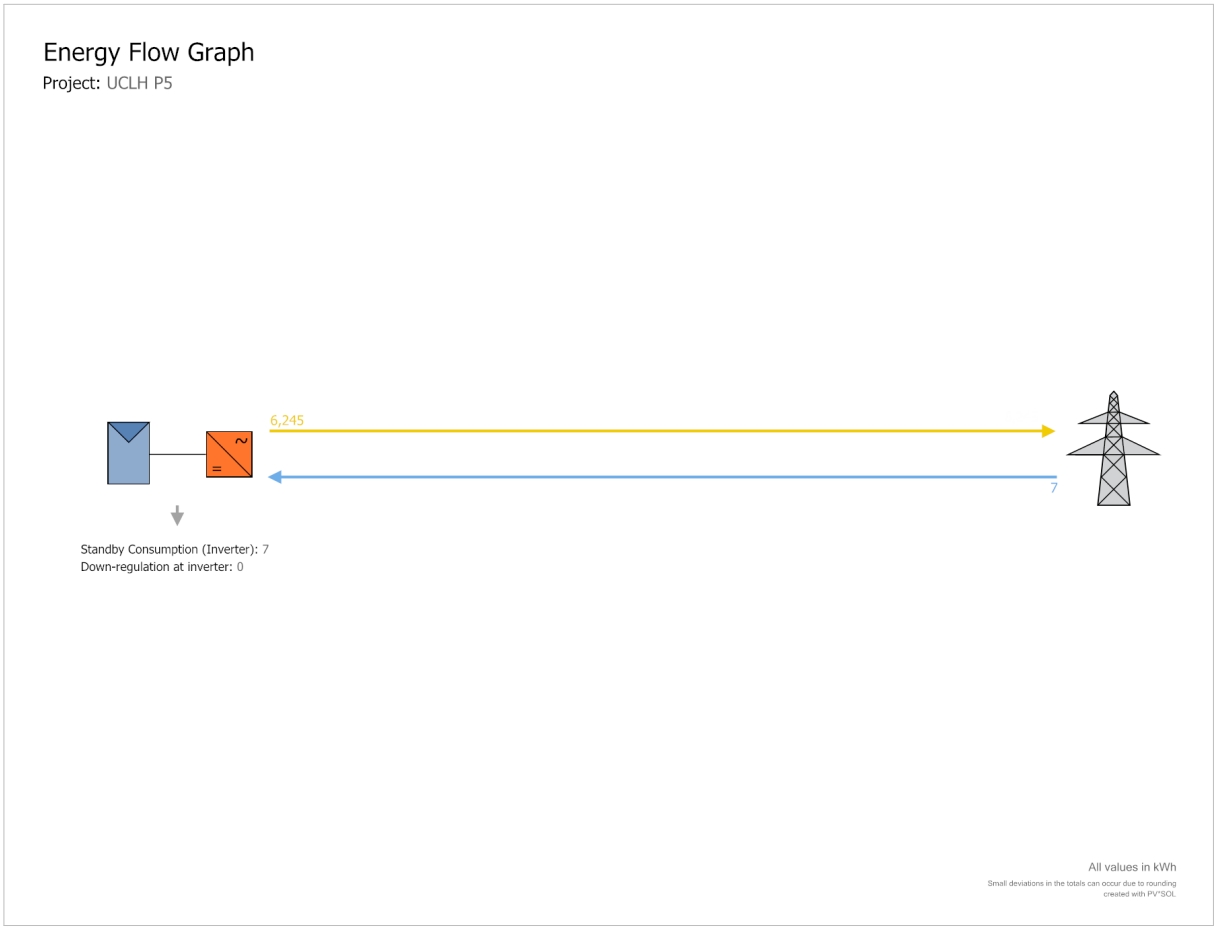
Number of Phases	3	
Mains Voltage (1-phase)	230	V
Displacement Power Factor (cos phi)	+/- 1	

* The guarantee provisions of the respective manufacturer apply

Simulation Results

PV System

PV Generator Output	7.6	kWp
Spec. Annual Yield	826.10	kWh/kWp
Performance Ratio (PR)	87.9	%
Grid Feed-in	6,245	kWh/year
Grid Feed-in in the first year (incl. module degradation)	6,033	kWh/year
Standby Consumption (Inverter)	7	kWh/year
CO_2 Emissions avoided	3,747	kg / year



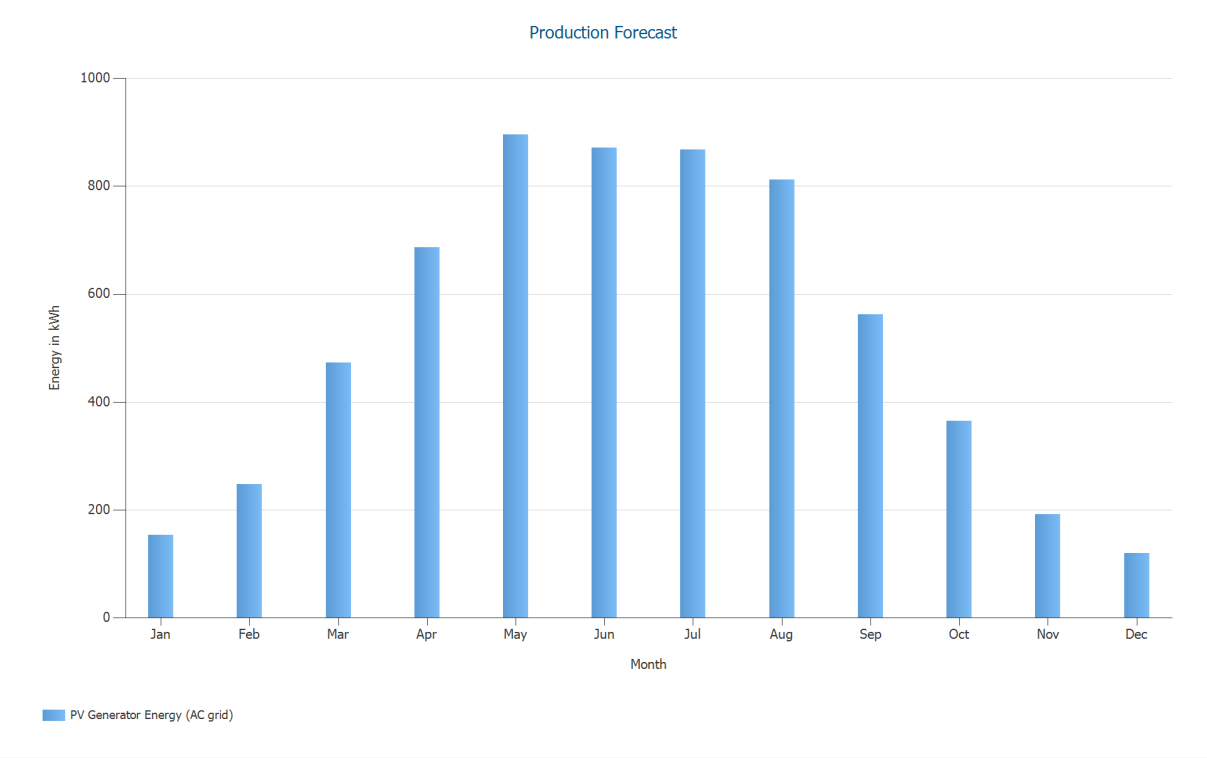


Figure: Production Forecast

Results per Module Area

Module Area 1

PV Generator Output	7.56	kWp
PV Generator Surface	43.5	m²
Global Radiation at the Module	939	kWh/m²
PV Generator Energy (AC grid)	6245.2	kWh/year
Spec. Annual Yield	826.1	kWh/kWp
Performance Ratio (PR)	87.9	%

PV System Energy Balance

Global radiation - horizontal	**975.3**	**kWh/m²**	
Deviation from standard spectrum	-9.75	kWh/m²	-1.00 %
Ground Reflection (Albedo)	1.47	kWh/m²	0.15 %
Orientation and inclination of the module surface	42.67	kWh/m²	4.41 %
Shading	-70.68	kWh/m²	-7.00 %
Reflection on the Module Interface	0.00	kWh/m²	0.00 %
Global Radiation at the Module	**939.0**	**kWh/m²**	
	939.0	kWh/m²	
	x 43.52	m²	
	= 40,869.5	kWh	
Global PV Radiation	**40,869.5**	**kWh**	
Soiling	0.00	kWh	0.00 %
STC Conversion (Rated Efficiency of Module 17.39 %)	-33,762.49	kWh	-82.61 %
Rated PV Energy	**7,107.0**	**kWh**	
Low-light performance	-148.91	kWh	-2.10 %
Deviation from the nominal module temperature	-81.07	kWh	-1.17 %
Diodes	-34.39	kWh	-0.50 %
Mismatch (Manufacturer Information)	-136.85	kWh	-2.00 %
Mismatch (Configuration/Shading)	0.00	kWh	0.00 %
PV Energy (DC) without inverter down-regulation	**6,705.8**	**kWh**	
Failing to reach the DC start output	-2.20	kWh	-0.03 %
Down-regulation on account of the MPP Voltage Range	0.00	kWh	0.00 %
Down-regulation on account of the max. DC Current	0.00	kWh	0.00 %
Down-regulation on account of the max. DC Power	0.00	kWh	0.00 %
Down-regulation on account of the max. AC Power/cos phi	-0.17	kWh	0.00 %
MPP Matching	-37.94	kWh	-0.57 %
PV energy (DC)	**6,665.5**	**kWh**	
Energy at the Inverter Input	**6,665.5**	**kWh**	
Input voltage deviates from rated voltage	-99.41	kWh	-1.49 %
DC/AC Conversion	-225.64	kWh	-3.44 %
Standby Consumption (Inverter)	-7.17	kWh	-0.11 %
Total Cable Losses	-95.22	kWh	-1.50 %
PV energy (AC) minus standby use	**6,238.0**	**kWh**	
Grid Feed-in	**6,245.3**	**kWh**	

PV Module: LG360S2W-A5

Manufacturer	LG Electronics Inc.	
Available	Yes	

Electrical Data

Cell Type	Si monocrystalline	
Only Transformer Inverters suitable	No	
Number of Cells	72	
Number of Bypass Diodes	3	

Mechanical Data

Width	1024	mm
Height	2024	mm
Depth	40	mm
Frame Width	10	mm
Weight	21.7	kg
Framed	No	

I/V Characteristics at STC

MPP Voltage	37.7	V
MPP Current	9.56	A
Nominal output	360	W
Open Circuit Voltage	46.6	V
Short-Circuit Current	10.12	A
Increase open circuit voltage before stabilisation	0	%

I/V Part Load Characteristics

Values source	Manufacturer/user-created	
Irradiance	200	W/m²
Voltage in MPP at Part Load	38.37	V
Current in MPP at Part Load	1.82	A
Open Circuit Voltage (Part Load)	44.7	V
Short Circuit Current at Part Load	2	A

Further

Voltage Coefficient	-137.4	mV/K
Electricity Coefficient	2.96	mA/K
Output Coefficient	-0.41	%/K
Incident Angle Modifier	100	%
Maximum System Voltage	1000	V
Spec. Heat Capacity	920	J/(kg*K)
Absorption Coefficient	70	%
Emissions Coefficient	85	%

Inverter: Growatt 6000UE

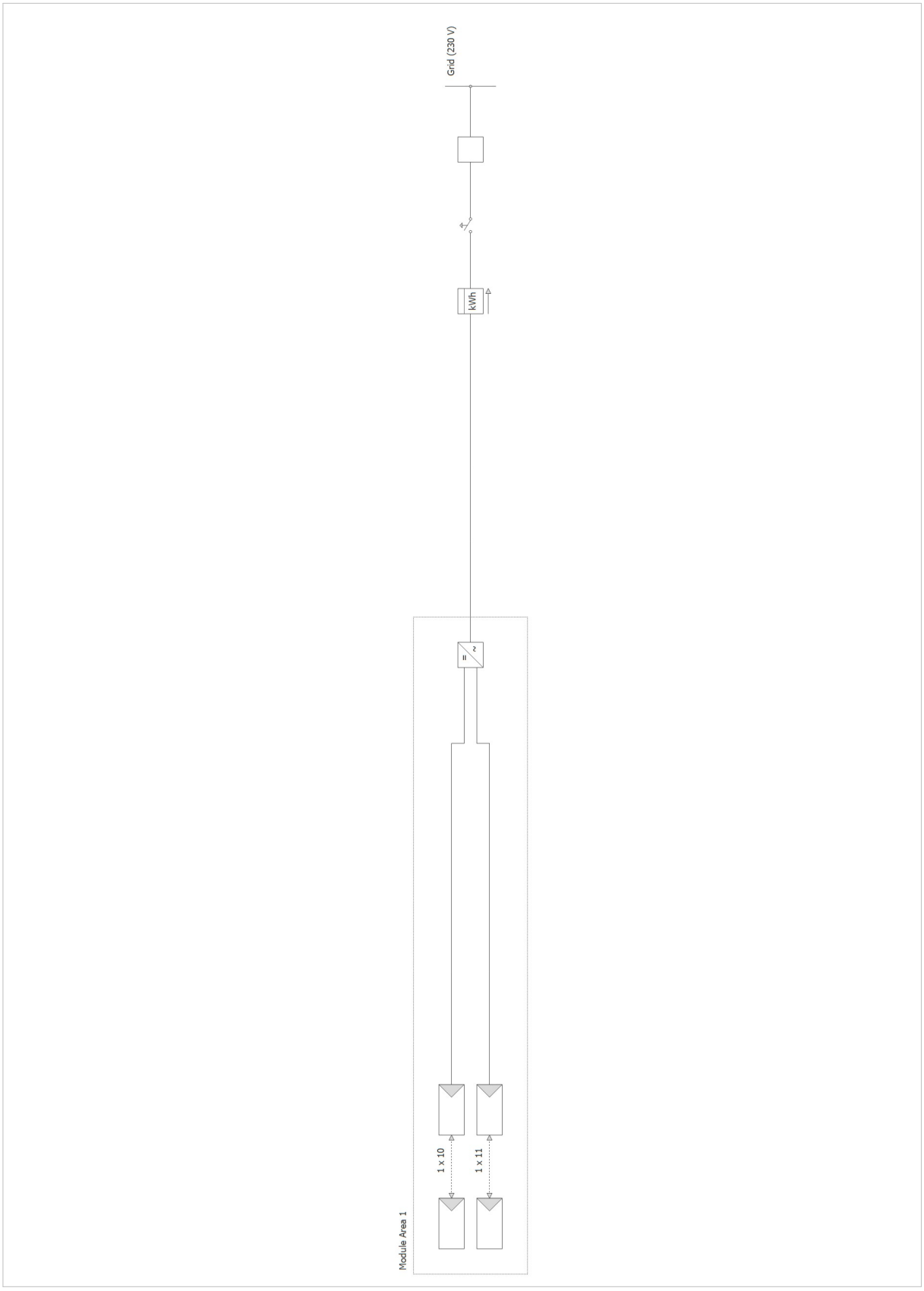
Manufacturer	GROWATT New Energy Co., Ltd.	
Available	Yes	

Electrical Data

DC Power Rating	6.3	kW
AC Power Rating	6	kW
Max. DC Power	6.3	kW
Max. AC Power	6	kVA
Standby Consumption	5	W
Night Consumption	0.5	W
Feed-in from	20	W
Max. Input Current	20	A
Max. Input Voltage	800	V
Nom. DC Voltage	580	V
Number of Feed-in Phases	3	
Number of DC Inlets	2	
With Transformer	No	
Change in Efficiency when Input Voltage deviates from Rated Voltage	0.9	%/100V

MPP Tracker

Output Range < 20% of Power Rating	99	%
Output Range > 20% of Power Rating	99.5	%
No. of MPP Trackers	2	
Max. Input Current per MPP Tracker	10	A
Max. Input Power per MPP Tracker	6	kW
Min. MPP Voltage	250	V
Max. MPP Voltage	750	V


Grid (230 V)
kWh
1 x 10
1 x 11
Module Area 1