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Renewing Your Energy Options

Solar PV Installation Handover Pack

Job Reference	**5409-PV-Wilmot Place**
Installation Date	**4th June 2015**
Commissioning Date	**4th June 2015**
Peak System Output	**1.5kWp**
System Modules	**REC REC250PE**
System Inverter	**SMA SB 1600TL-10**

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SECTION 1

Introduction

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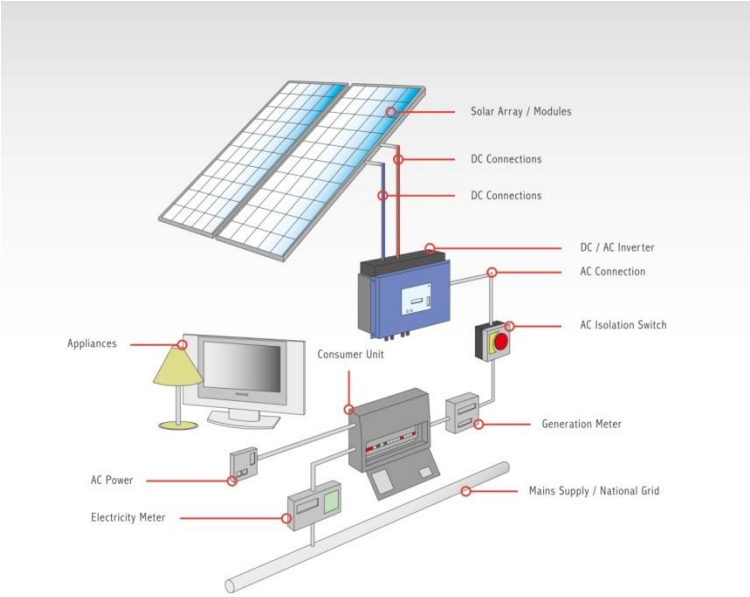
Introduction to Solar PV

The term 'photovoltaic' means the direct conversion of light into electrical energy using solar cells. In simple terms, the sun's light travels through the atmosphere hitting the solar cells and creating electricity – it's that simple!

The electricity generated by a solar array (a collection of solar modules) is in the form of 'direct current' (DC) which needs to be converted into 'alternating current' (AC) for general usage. This is done by an 'inverter', which takes the DC electricity from the array and exports AC electricity to your consumer unit or fuse board. You can either use this electricity directly, or export it to the national grid.

Also install is a 'generation meter' which logs all the electricity that the system generates. It is the reading from this meter that you will need to give to your electricity provider in order to receive the FiT payments.



The system is completely self-maintaining and does not require any regular maintenance or checking. There are no moving parts within the solar modules or the inverter, and all components come with warranties and guarantees to ensure peace of mind.

The efficiency of most solar modules will reduce over a 25 year period, the extent of which is stated by the manufacturers. The inverter will work very efficiently and again comes with a manufacturer's guarantee.

People tend to think that the UK is not in an appropriate position to gain from the technologies of solar photovoltaic (PV) systems due to a lack of sunshine, however this assumption is incorrect. Solar PV panels (modules) function from daylight, they do not need pure brilliant sunshine. In fact, they actually work better when cooler, so a clear sunny winter's day can give as high an output as a hot summer's day.

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SECTION 2

System Design, Specification & Technical Data

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Estimated System Performance Calculation

The performance of solar photovoltaic systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This estimate is based upon the standard MCS procedure and is given as guidance only. It should not be considered as a guarantee of performance.

In order to calculate the estimated system performance, we are required to follow the 'Standard Estimation Method', for which the procedure is as follows;

1. Establish the electrical rating of the PV array (kWp)
2. Determine the postcode region taken from the figure given in the 'MCS ECA Guide to the Installation of Photovoltaic Systems'
3. Determine the array pitch
4. Determine the array orientation
5. Look up the kWh/kWp (Kk) for the location from the specific table given in the 'MCS ECA Guide to the Installation of Photovoltaic Systems'
6. Determine the shading factor of the array (SF) according to any objects blocking the horizon - using shad factor procedure set out in 3.7.7

The estimated annual electricity generated (AC) in kWh/year of installed system shall then be determined using the following formula:

Annual AC Output (kWh) = kWp x Kk x Shading Factor (SF)

Standard Estimation Method	
A. Installation Data	
kWp installed:	1.50
Regional Zone	Zone 1 - Thames
Array Pitch - degrees from horizontal:	20
Array Orientation - degrees from South	10
B. Calculations	
kWh/kWp Value (Kk) from table	945
Shade Factor:	1.00
Estimated annual performance (kWh)	**1,418**

This system performance calculation has been undertaken using estimated values for array orientation, inclination or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values.

This shade assessment has been undertaken using the standard MCS procedure - it is estimated that this method will yield results within 10% of the actual annual energy yield for most systems.

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Wind Loading Calculations

Williams Renewables ensure that the roof structure is capable of withstanding the loads (static and wind loads) that will be imposed by the solar PV modules and their mounting arrangements. If there is any doubt, a structural engineer will also be consulted. Guidance on the mechanical installation and wind loads for the following calculations are taken from BRE Digests 495 and 489 or BS 6399.

Wind Uplift (F) = Qs x Cp,net x Ca x Aref	
Qs = the dynamic wind pressure, obtained from the simplified method given in Digest 489, at the reference height H, which is taken as the maximum height of the roof	1120
Cp,net = the appropriate pressure coefficient for the system under consideration	-0.7
Ca = the size effect factor from BS6399-2, safely taken as 1.0	1
Aref = the loaded area for the system. For overall loads on individual PV modules, it will be the area of the module exposed to the wind	1.65
Wind Loading Calculation (F)	-1296.13

Downward Pressure (F) = Qs x Cp,net x Ca x Aref	
Qs = the dynamic wind pressure, obtained from the simplified method given in Digest 489, at the reference height H, which is taken as the maximum height of the roof	1120
Cp,net = the appropriate pressure coefficient for the system under consideration	1
Ca = the size effect factor from BS6399-2, safely taken as 1.0	1
Aref = the loaded area for the system. For overall loads on individual PV modules, it will be the area of the module exposed to the wind	1.65
Wind Loading Calculation (F)	1851.61

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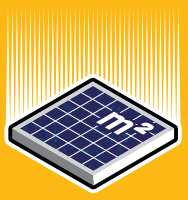
ENERGIZING LIFE TOGETHER

REC

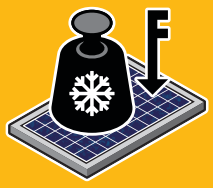
HIGH PERFORMANCE SOLAR MODULES

REC PEAK ENERGY SERIES

REC Peak Energy Series modules are the perfect choice for building solar systems that combine long lasting product quality with reliable power output. REC combines high quality design and manufacturing standards to produce high-performance solar modules with uncompromising quality.



MORE POWER PER M²

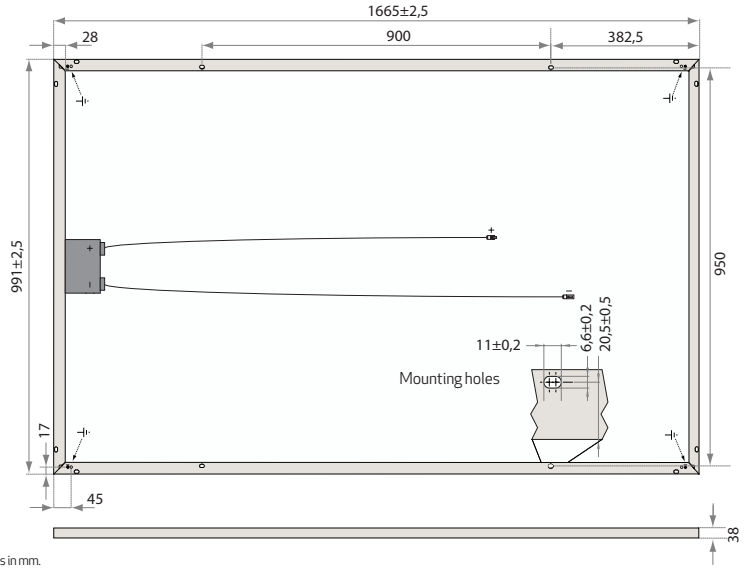


ROBUST AND DURABLE DESIGN

ENERGY PAYBACK TIME OF ONE YEAR

OPTIMIZED FOR ALL SUNLIGHT CONDITIONS

REC PEAK ENERGY SERIES



Measurements in mm.

15.8% EFFICIENCY

10 YEAR PRODUCT WARRANTY

25 YEAR LINEAR POWER OUTPUT WARRANTY

TEMPERATURE RATINGS

Nominal operating cell temperature (NOCT)	45.7°C (±2°C)
Temperature coefficient of P_{MPP}	-0.40 %/°C
Temperature coefficient of V_{OC}	-0.27 %/°C
Temperature coefficient of I_{SC}	0.024 %/°C

ELECTRICAL DATA @ STC

	REC235PE	REC240PE	REC245PE	REC250PE	REC255PE	REC260PE
Nominal Power - P_{MPP} (Wp)	235	240	245	250	255	260
Watt Class Sorting - (W)	0/+5	0/+5	0/+5	0/+5	0/+5	0/+5
Nominal Power Voltage - V_{MPP} (V)	29.5	29.7	30.1	30.2	30.5	30.7
Nominal Power Current - I_{MPP} (A)	8.06	8.17	8.23	8.30	8.42	8.50
Open Circuit Voltage - V_{OC} (V)	36.6	36.8	37.1	37.4	37.6	37.8
Short Circuit Current - I_{SC} (A)	8.66	8.75	8.80	8.86	8.95	9.01
Module Efficiency (%)	14.2	14.5	14.8	15.1	15.5	15.8

Analysed data demonstrates that 99.7% of modules produced have current and voltage tolerance of ±3% from nominal values.
Values at standard test conditions STC (airmass AM 1.5, irradiance 1000 W/m², cell temperature 25°C).
At low irradiance of 200 W/m² (AM 1.5 and cell temperature 25°C) at least 97% of the STC module efficiency will be achieved.

GENERAL DATA

Cell type:	60 REC PE multi-crystalline 3 strings of 20 cells with bypass diodes
Glass:	3.2 mm solar glass with anti-reflection surface treatment
Back sheet:	Double layer highly resistant polyester
Frame:	Anodized aluminium (silver)
Junction box:	IP67 rated 4 mm² solar cable, 0.9 m + 1.2 m
Connectors:	Multi-Contact MC4 (4 mm²)
Origin	Made in Singapore

ELECTRICAL DATA @ NOCT

	REC235PE	REC240PE	REC245PE	REC250PE	REC255PE	REC260PE
Nominal Power - P_{MPP} (Wp)	179	183	187	189	193	197
Nominal Power Voltage - V_{MPP} (V)	27.5	27.7	28.1	28.3	28.5	29.0
Nominal Power Current - I_{MPP} (A)	6.51	6.58	6.64	6.68	6.77	6.81
Open Circuit Voltage - V_{OC} (V)	34.2	34.4	34.7	35.0	35.3	35.7
Short Circuit Current - I_{SC} (A)	6.96	7.03	7.08	7.12	7.21	7.24

Nominal operating cell temperature NOCT (800 W/m², AM 1.5, windspeed 1 m/s, ambient temperature 20°C).

MAXIMUM RATINGS

Operational temperature:	-40 ... +85°C
Maximum system voltage:	1000 V
Maximum snow load:	550 kg/m² (5400 Pa)
Maximum wind load:	244 kg/m² (2400 Pa)
Max series fuse rating:	25 A
Max reverse current:	25 A

CERTIFICATIONS

IEC 61215 & IEC 61730, IEC 62716 (ammonia resistance) & IEC 61701 (salt mist - severity level 6).

Member of PV Cycle

WARRANTY

10 year product warranty
25 year linear power output warranty
(max. degression in performance of 0.7% p.a.)

See warranty conditions for further details.

MECHANICAL DATA

Dimensions:	1665 x 991 x 38 mm
Area:	1.65 m²
Weight:	18 kg

Note! Specifications subject to change without notice.

Rev Q - 10.2013. This datasheet is EN 50380 compliant

REC is a leading global provider of solar electricity solutions. With nearly two decades of expertise, we offer sustainable, high-performing products, services and investment opportunities for the solar and electronics industries. Together with our partners, we create value by providing solutions that better meet the world's growing electricity needs. Our 2,300 employees worldwide generated revenues of more than NOK 7 billion in 2012, approximately EUR 1 billion.

REC

www.recgroup.com

Efficient
- Efficiency of up to 96 %
- Transformerless

Reliable
- Integrated ESS DC switch-disconnector (optional)

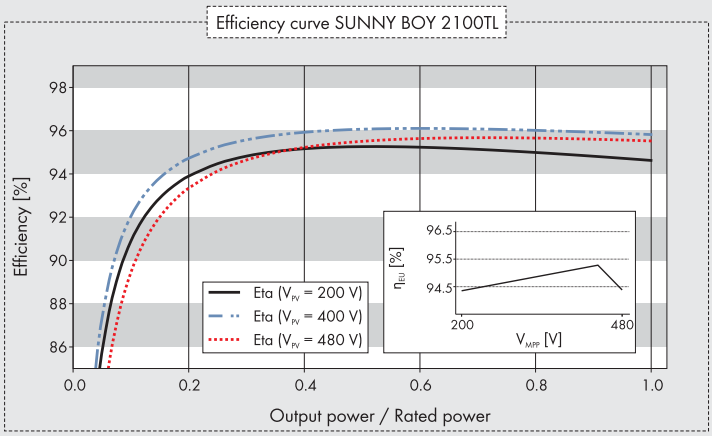
Reliable
- Proven technology
- Maintenance free, thanks to convection cooling

Simple
- SUNCLIX DC plug-in system

SUNNY BOY 1300TL / 1600TL / 2100TL

Small inverters with big results

Combining broad input voltage and current ranges, this transformerless Sunny Boy can be connected to nearly all standard crystalline PV modules. As a proven starter model among the transformerless inverters, its efficiency is top-class. Its low weight and robust enclosure allow simple installation, both indoors and outdoors. With its two performance classes, it is the ideal inverter for smaller PV plants.



Accessories

RS485 interface
485PB-NR

Bluetooth Piggy-Back
BTPBINV-NR

* Does not apply to all national appendixes to EN 50438

● Standard features ○ Optional features – Not available

For SUNNY BOY 1600TL:

Provisional data, as of July 2011

Data at nominal conditions

Technical Data	Sunny Boy 1300TL	Sunny Boy 1600TL	Sunny Boy 2100TL
Input (DC)			
Max. DC power (@ cos φ = 1)	1400 W	1700 W	2200 W
Max. input voltage	600 V	600 V	600 V
MPP voltage range / rated input voltage	125 V ... 480 V / 400 V	155 V – 480 V / 400 V	200 V – 480 V / 400 V
Min. input voltage / initial input voltage	125 V / 150 V	125 V / 150 V	125 V / 150 V
Max. input current	11 A	11 A	11 A
Max. input current per string	11 A	11 A	11 A
Number of independent MPP inputs / strings per MPP input	1 / 1	1 / 1	1 / 2
Output (AC)			
Rated power (@ 230 V, 50 Hz)	1300 W	1600 W	1950 W
Max. apparent AC power	1300 VA	1600 VA	2100 VA
Nominal AC voltage / range	220 V, 230 V, 240 V / 180 V – 260 V		
AC power frequency / range	50 Hz / –4.5 Hz ... +2.5 Hz		
Rated power frequency / rated grid voltage	50 Hz / 230 V	50 Hz / 230 V	50 Hz / 230 V
Max. output current	7.2 A	8.9 A	11 A
Power factor at rated power	1	1	1
Feed-in phases / connection phases	1 / 1	1 / 1	1 / 1
Efficiency			
Max. efficiency / European weighted efficiency	96 % / 94.3 %	96 % / 95 %	96 % / 95.2 %
Protective devices			
DC disconnect device	○	○	○
Ground fault monitoring / grid monitoring	● / ●	● / ●	● / ●
DC reverse polarity protection / AC short-circuit current capability / galvanically isolated	● / ● / –	● / ● / –	● / ● / –
All-pole-sensitive residual-current monitoring unit	●	●	●
Protection class (according to IEC 62103) / overvoltage category (according to IEC 60664-1)	I / III	I / III	I / III
General data			
Dimensions (W / H / D)	440 / 339 / 214 mm (17.3 / 13.4 / 8.4 inch)		
Weight	16 kg / 35.3 lb	16 kg / 35.3 lb	16 kg / 35.3 lb
Operating temperature range	–25 °C ... +60 °C / –13 °F ... +140 °F		
Noise emission (typical)	33 dB(A)	33 dB(A)	33 dB(A)
Self-consumption (night)	0.1 W	0.1 W	0.1 W
Topology	Transformerless	Transformerless	Transformerless
Cooling concept	Convection	Convection	Convection
Degree of protection (according to IEC 60529)	IP65	IP65	IP65
Degree of protection of connection area (according to IEC 60529)	IP65	IP65	IP65
Climatic category (according to IEC 60721-3-4)	4K4H	4K4H	4K4H
Max. permissible value for relative humidity (non-condensing)	100 %	100 %	100 %
Features			
DC connection / AC connection	SUNCLIX / Connector	SUNCLIX / Connector	SUNCLIX / Connector
Display	Text line	Text line	Text line
Interface: RS485 / *Bluetooth*®	○ / ○	○ / ○	○ / ○
Warranty: 5 / 10 / 15 / 20 / 25 years	● / ○ / ○ / ○ / ○	● / ○ / ○ / ○ / ○	● / ○ / ○ / ○ / ○
Certificates and approvals (more available on request)	G83/1-1, PPC, AS 4777, EN 50438*, C10/11, PPDS, UTE C15-712-1, VDE-AR-N 4105, RD1699		
Certificates and approvals (planned)	CEI 0-21		
Type designation	SB 1300TL-10	SB 1600TL-10	SB 2100TL

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Managing Board: Roland Grebe, Lydia Sommer, Pierre-Pascal Urbon, Marko Werner

Certificate G83/2

Engineering Recommendation

Manufacturer	**SMA Solar Technology AG**
Address	Sonnenallee 1
Postal code, place	34266, Niestetal
Country	Germany

Test house details	**SMA Solar Technology AG**
Test period	From 2013-08-30 until 2014-02-07

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
SB 2100TL	2100	1950	4.58
SB 1600TL-10	1600	1600	4.58
SB 1300TL-10	1300	1300	4.58

The results of the G83/2 are summarized in this certificate. SMA declares that all units shipped to the UK, with at least the aforementioned FW version, are within the specifications and parameters set by the G83/2 Engineering Recommendation. These settings cannot be changed by an installer, user or by any person other than SMA. Note that all tests were carried out in the biggest inverter of the family under test. The results for the other inverters of the family are equivalent.

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Test Results

Power quality

Harmonics as per BS EN 61000-3-2								
Order	Frequency [Hz]	Thresholds [A]	P/Pn [%]				Max. NV / Limit [%]	
			50		100			
			MV [A]	NV [A]	MV [A]	NV [A]		
2	100	1,08	0,0086	0,0163	0,0161	0,0303	2,81%	✓
3	150	2,3	0,1037	0,1957	0,1196	0,2258	9,82%	✓
4	200	0,43	0,0054	0,0102	0,0061	0,0115	2,68%	✓
5	250	1,14	0,0685	0,1293	0,0841	0,1587	13,92%	✓
6	300	0,3	0,0054	0,0101	0,0049	0,0093	3,37%	✓
7	350	0,77	0,0485	0,0916	0,0709	0,1339	17,38%	✓
8	400	0,23	0,0105	0,0199	0,0063	0,0118	8,65%	✓
9	450	0,4	0,0100	0,0189	0,0457	0,0863	21,57%	✓
10	500	0,184	0,0079	0,0149	0,0055	0,0104	8,12%	✓
11	550	0,33	0,0066	0,0125	0,0330	0,0624	18,89%	✓
12	600	0,153	0,0041	0,0078	0,0028	0,0052	5,09%	✓
13	650	0,21	0,0127	0,0240	0,0284	0,0536	25,53%	✓
14	700	0,131	0,0080	0,0151	0,0061	0,0115	11,48%	✓
15	750	0,15	0,0189	0,0356	0,0200	0,0377	25,16%	✓
16	800	0,115	0,0085	0,0161	0,0040	0,0075	13,96%	✓
17	850	0,132	0,0115	0,0217	0,0068	0,0129	16,40%	✓
18	900	0,102	0,0032	0,0061	0,0021	0,0040	5,95%	✓
19	950	0,118	0,0178	0,0336	0,0031	0,0058	28,41%	✓
20	1000	0,092	0,0022	0,0041	0,0068	0,0128	13,97%	✓
21	1050	0,107	0,0115	0,0217	0,0048	0,0090	20,23%	✓
22	1100	0,084	0,0034	0,0064	0,0019	0,0036	7,62%	✓
23	1150	0,098	0,0039	0,0074	0,0092	0,0173	17,73%	✓
24	1200	0,077	0,0032	0,0061	0,0027	0,0050	7,93%	✓
25	1250	0,09	0,0050	0,0093	0,0074	0,0140	15,52%	✓
26	1300	0,071	0,0018	0,0034	0,0016	0,0031	4,87%	✓
27	1350	0,083	0,0029	0,0055	0,0061	0,0116	13,89%	✓
28	1400	0,066	0,0014	0,0027	0,0012	0,0023	4,05%	✓
29	1450	0,078	0,0028	0,0053	0,0049	0,0093	12,01%	✓
30	1500	0,061	0,0013	0,0025	0,0012	0,0022	4,14%	✓
31	1550	0,073	0,0022	0,0041	0,0045	0,0085	11,73%	✓
32	1600	0,058	0,0026	0,0050	0,0017	0,0033	8,62%	✓
33	1650	0,068	0,0038	0,0071	0,0061	0,0115	16,81%	✓
34	1700	0,054	0,0012	0,0024	0,0026	0,0049	9,11%	✓
35	1750	0,064	0,0013	0,0025	0,0055	0,0105	16,26%	✓
36	1800	0,051	0,0011	0,0021	0,0014	0,0026	5,18%	✓
37	1850	0,061	0,0014	0,0027	0,0039	0,0074	12,23%	✓
38	1900	0,048	0,0011	0,0021	0,0022	0,0042	8,76%	✓
39	1950	0,058	0,0010	0,0019	0,0029	0,0055	9,53%	✓
40	2000	0,046	0,0009	0,0017	0,0010	0,0018	3,98%	✓

MV - Measured Value NV - Normalized Value NV=MV*3,68/power per phase

ZE_G83-2_SBxx00TL-10_en_10

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Test Results

Power quality

Voltage fluctuations and flicker as per BS EN 61000-3-3								
	Starting			Stopping			Running	
	dmax	dc	d(t) in ms	dmax	dc	d(t) in ms	Pst	Plt (2hours)
Limit	4,0%	3,3%	500	4,0%	3,3%	500	1	0,65
MV	0,1%	0,0%	0	0,0%	0,0%	0	0,10	0,10
NV	0,1%	0,0%	0	0,0%	0,0%	0	0,19	0,19
Verification	✓	✓	✓	✓	✓	✓	✓	✓

DC injection			
	P/Pn [%]		
	10	55	100
Limit	0,25% In	0,25% In	0,25% In
MV	0,02066 A	0,0202 A	0,0205 A
%Inom	0,24%	0,24%	0,24%
Verification	✓	✓	✓

Power factor			
	Voltage [V]		
	218,2	230	253
Limit	0,95	0,95	0,95
MV	1,00	1,00	1,00
Verification	✓	✓	✓

MV - Measured value NV - Normalized value

Protection - Grid monitoring and reconnection time

Trip Tests	G83/2		Setting		Measures Values		Verification
Function	Magnitude	Time	Magnitude	Time	Magnitude	Time	
Undervoltage stage 1	200,1 V	2,5 s	200,1 V	2,5 s	200,61 V	2,59 s	✓
Undervoltage stage 2	184 V	0,5 s	184 V	0,5 s	184,56 V	0,54 s	✓
Overvoltage stage 1	262,2 V	1 s	262,2 V	1 s	262,74 V	1,09 s	✓
Overvoltage stage 2	273,7 V	0,5 s	273,7 V	0,5 s	275,42 V	0,54 s	✓
Underfrequency stage 1	47,5 Hz	20 s	47,5 Hz	20 s	47,447 Hz	20,05 s	✓
Underfrequency stage 2	47 Hz	0,5 s	47 Hz	0,5 s	46,997 Hz	0,56 s	✓
Overfrequency stage 1	51,5 Hz	90 s	51,5 Hz	90 s	51,549 Hz	90,06 s	✓
Overfrequency stage 2	52 Hz	0,5 s	52 Hz	0,5 s	52,048 Hz	0,56 s	✓

No trip test	G83/2		Verification
	Magnitude	Time	
U/V 1	204,1 V	3,5 s	✓
U/V 2	188 V	2,48 s	✓
U/V 3	180 V	0,48 s	✓
O/V 1	258,2 V	2 s	✓
O/V 2	269,7 V	0,98 s	✓
O/V 3	277,7 V	0,48 s	✓

No trip test	G83/2		Verification
	Magnitude	Time	
U/F 1	47,7 Hz	25 s	✓
U/F 2	47,2 Hz	19,98 s	✓
U/F 3	46,8 Hz	0,48 s	✓
O/F 1	51,3 Hz	95 s	✓
O/F 2	51,8 Hz	89,98 s	✓
O/F 3	52,2 Hz	0,48 s	✓

Reconnection time			
Limit	Setting	MV	Verification
20 s	20 s	31,44 s	✓

No reconnection			
At 266,2 V	At 198,1 V	At 47,4 Hz	At 51,8 Hz
✓	✓	✓	✓

ZE_G83-2_SBxx00TL-10_en_10

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Amtsgericht Kassel (District Court) HRB (registration number) 3972
Vorsitzender des Aufsichtsrats (Chairman of the Supervisory Board): Günther Cramer
Managing Board: Roland Grebe, Lydia Sommer, Pierre-Pascal Urbon, Marko Werner

Test Results

Protection

Loss of mains test according to the BS EN 62116						
Test power and imbalance	29 % -5%Q (Test 22)	58 % -5%Q (Test 12)	100 % -5%P (Test 5)	29 % +5%Q (Test 31)	58 % +5%Q (Test 21)	100 % +5%P (Test 10)
Trip time limit (s)	0,5	0,5	0,5	0,5	0,5	0,5
Measured Value L1 (s)	0,289	0,265	0,25	0,19	0,168	0,296
Measured Value L2 (s)	N/A	N/A	0,19	N/A	N/A	N/A
Measured Value L3 (s)	N/A	N/A	N/A	N/A	N/A	N/A
Measured Value L1L2L3 (s)*	N/A	N/A	N/A	N/A	N/A	N/A
Verification	✓	✓	✓	✓	✓	✓

* Only applicable to three phase inverters

Frequency change - Stability test				
	Start frequency	Change	End frequency	Verification
Positive vector shift	49,5 Hz	+9 degrees	N/A	✓
Negative vector shift	50,5 Hz	-9 degrees	N/A	✓
Positive frequency drift	49,5 Hz	+0,19 Hz/s	51,5 Hz	✓
Negative frequency drift	50,5 Hz	-0,19 Hz/s	47,5 Hz	✓

Fault level contribution		
Time after fault	Voltage (V)	Current (A)
< 50 ms	231,39	11,71
100 ms	11,56	0,01
250 ms	11,34	0,01
500 ms	11,36	0,01
Time to Trip	0,05	in seconds

Self monitoring - solid state switching
Not applicable as electro-mechanical relays are used

ZE_G83-2_SBxx00TL-10_en_10

A100C BS Single Phase Meter

Compact yet
advanced domestic metering...

Features

- Accuracy Class 1 or Class 2
- kWh import or kWh import/export
- 20 years certified life
- Large digit (9.8mm) multilingual display with chevron information indication
- Extensive security data
- Communications as standard
- 12kV impulse withstand
- High security, compact design
  (130mm Wide x 97mm High x 47mm Deep)
- BS double insulated, glass filled polycarbonate case
- Permanently fixed main cover
- Rate select for two rate meters, switch to neutral.
- IP53 in accordance with IEC 60529:1989

Options

- One or two rates controlled by external device
- IrDA communications or IEC 62056-21 (formerly IEC 1107) optical communications for red sensitive probes
- IEC - 62056-21 for infrared only optical probes
- Auxiliary terminals configured for:
  - SO Pulse output (IEC 62053-31)
  - Serial data output (IrDA meter)
- A102C - kWh and kvarh energy measurement
- A103C - Maximum demand,
  Voltage and current instrumentation values
- Extended terminal cover

The successful range of A100C meters from Elster Metering Systems provide a cost effective solution for one or two rate domestic applications.
The meter is housed in an extremely compact case. To enhance security, the main meter cover is permanently secured to the base during the manufacturing process.

The meter offers high security and detects many of the most commonly used tamper techniques.
The security data can be included as part of the display sequence and read via the optical communications port.

The A100C has the option of IrDA or optical IEC 62056-21 communications. Both methods of communication allow the meter registers and security data to be read electronically from a laptop or hand-held device, greatly reducing the possibility of manual meter reading errors.

The A100C can be a simple import meter or for import/export, domestic or small scale generation sites. The meter offers one or two rate operation.

The A102C measures reactive energy in addition to active energy and is ideally suited for utilities who wish to bill or monitor energy consumption based on kvarh measurement. The A103C meter offers additional instrumentation values and maximum demand.

Meters are approved to EN 62053-21:2003, have an ingress protection of IP53 to IEC 60529:1989 and comply with EMC standard EN 50081-1 1992.

elster

Display

The liquid crystal display is programmable to meet a customer's requirements. The chevrons and index digit indicate the information being displayed. The nameplate information can be printed in any language.

Security Data

The A100C offers many useful security features. The meter stores all registration and security data to non-volatile memory. This data can be shown on the display. All data is retained for the life of the meter. Recordable security features are listed below:

- Reverse run event count
- Reverse run energy total
- Reverse run indication on LCD
- Power fail count
- Elapsed time count
- Time in rate 1 and rate 2
- Hours since last power-up
- Hours spent in anti-creep

As an option the kWh register can increment in power flow insensitive mode i.e. it increments regardless of energy flow direction.

Communications

Optical Port

IrDA Port

The A100C has the option of IrDA (Infrared Data association) data stream communications or optical IEC 62056-21 (formerly IEC 1107) two way communications. The table below shows the functions available for each type of communications:

	Configure Meter	Meter Data Via Optical Port	Meter Data Via Auxiliary Terminals
IEC 62056	Yes	Yes	No
IrDA	No	Yes	Yes

Pulse Output

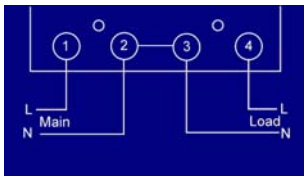
An opto-isolated pulse output can provide the basis for an energy management system or AMR. These pulses are output via the auxiliary terminals.

Technical Data

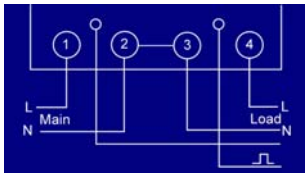
Current Range Voltage Range Frequency System Connection	10-100A, 20-100A 220-250V, 110-127V 50 or 60Hz 1phase 2 wire
Burden (230V)	0.66W, 8.5VA (capacitive burden)
Insulation Impulse Withstand	4kV RMS 50Hz 12kV 1.2/50µS 40 ohm source
Display	9.8mm x 3.5mm characters High contrast, wide angle
IrDA Baud Rates IEC 62056 - 21 Rate Serial Baud Rates	2400, 4800 or (9600 without serial port) 2400 or 4800 2400 or 4800
Certified Product Life	20 years (OFGEM model)
Temperature Humidity	-20° to + 55° C (operational range) -25° to + 85° C (storage) Annual Mean 75% (for 30 days spread over one year, 95%)
Pulse Output	100ms pulse 100 p /kWh (=10Wh/pulse) (other pulse rates, durations, available)
Weight	349 grams
Specifications Case	kWh Class 1 or 2 EN 62053-21:2003 kvarh Class 2 or Class 3 EN 62053-23 IP 53 to IEC 60529 : 1989

Terminal Arrangements

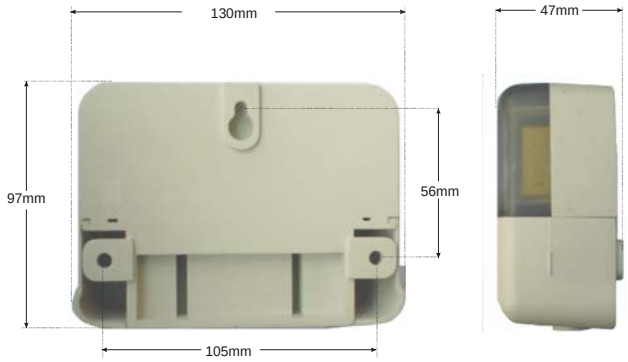
Single Rate



Pulsed Output



Dimensions and Fixing Centre



Elster Metering Systems

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Tel: 44 (0) 1785 275200
Web: www.elstermetering.com

SECTION 3

Operation and Maintenance Procedures

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Normal Operating Procedures

Under normal operating conditions there is no user involvement in the running of a Solar PV system. For specific inverter controls please refer to the User Manual given to you by the installer.

At the beginning of the day, the system will automatically turn on once the light has risen to a sufficient level, consequently generating the required minimum voltage for the inverter. After around 4 minutes, the inverter enables the grid-feeding process and the system will then continue to generate electricity throughout the day. When the light levels drop at the end of the day, the generated voltage will fall below the required level and the inverter will turn off until the following morning / rise in light level.

On low light days, such as during the winter, the system may turn itself on and off again a number of times during the morning and evening, when the level of voltage being generated rises and falls below the required minimum. This is not a sign of a fault but perfectly normal as the light levels fluctuate.

When the system in turned off, there will be a constant **RED** LED showing on the 'Generation Meter'. This indicates that no current is moving through the meter. Once the system has turned on, this LED will pulse relative to the amount of electricity being generated – the more electricity being generated the quicker it will pulse and visa versa.

Start-up / Shut-down Procedure

Start-up:

1. Ensure the circuit breaker is turned on at the Distribution Board
2. Insert the Electronic Disconnection Switch into the bottom of the Inverter
3. Switch the AC isolator below the Inverter to the 'On' position
4. Allow up to four minutes for the inverter to start generating

Shut-down:

1. Switch the AC isolator below the Inverter to the 'Off' position
2. Remove the Electronic Disconnection Switch from underneath the Inverter
3. Allow 30 minutes for the capacitors to discharge before removing the inverter cover

If the Solar PV system needs to be shut down, for example if there is any maintenance work necessary or electrical work is being carried out on any part of the electrical installation, ensure that the shut-down procedure is correctly followed. If you require any guidance, please contact Williams Renewables who will be able to help.

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Trouble-Shooting

How to tell if the Solar PV System is working properly?

Monitor the generation meter – if the system is generating electricity the meter should be representing this through a pulsing LED and the counter should be counting the number of kilo-watt hours you are generating.

Monitor the inverter display – all inverters have a display screen that will tell you when the system is generating electricity and how much electricity at one point is being generated. Refer to the User Manual for further information regarding the inverter operating functions.

What do I do if my system stops working?

Ensure your electricity supply from the national grid has not cut out. If it has your Solar PV system will not operate until the supply is restored.

Look at the inverter display screen to see if it has registered an error code. If so, refer to the trouble-shooting section in the User Manual, follow the guidance given and if necessary contact Williams Renewables for further advice.

If contacting Williams Renewables for further advice please ensure you have the following information;

- Inverter make, model and serial number
- PV module make and model
- A description of the error / any error message that is displayed on the inverter

What happens during a power-cut?

Due to necessary safety regulations, you are unable to continue generating your own electricity during a power cut. This is to protect anyone working to repair the national grid from receiving an electric shock which may be caused if you are exporting electricity whilst the grid is being worked on.

If you do experience a power cut, the inverter will shut down immediately and only begin to generate electricity again once it receives the appropriate electrical signal from the grid. You do not need to touch any part of the installation for this to happen, it operates completely independently and safely.

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Servicing and Maintenance

Do I need to service my Solar PV System?

As there are no moving parts in both the solar PV modules and the inverter there is very little maintenance necessary for the system and there are no components to wear out.

The modules are constructed using self-cleaning glass meaning that rainfall will remove the majority of dirt that may land on them. However if a module does suffer from a large build-up of dirt or leaves, it should be cleaned as soon as possible with measures taken to avoid a re-occurrence if at all possible.

A solar PV module needs to be clean in order for it to operate at its rated capacity. If there is dirt on a module, this blocks light from hitting the silicon crystals and reduces the power output. A layer of dust or grime can reduce power output by 15-25%.

The inverter has been designed and built for low maintenance, however it is advisable to check the device visually approximately every few months.

Cleaning the inverter is only necessary if a build-up of dirt has blocked the heat dissipation mechanism. If this has occurred, carefully remove the dirty with an appropriate soft brush or paintbrush.

- Inspect the solar panels on a regular basic, more so if located in a dusty area or prone to a lot of bird mess.
- Remove any debris or dirt you can see that is stuck onto the modules.
- Clean the glass of the solar modules with warm, soapy water.
- Do not use an abrasive cleaning pad.
- Do not stand on the panels or the mounting system.
- If the array is integrated into the roof, do not stand on any of the surrounding roof tiles.
- Check the airflow around the inverter has not been restricted.
- Check the inverter functions and LED indicators are correct for the system conditions at that time.
- Have the electrical wiring and system components checked by a fully qualified electrician periodically.

Refer to the manufacturer's instructions for further advice and best results.

Consideration of Future Potential Shading

It is very important to avoid shading of the array as much as possible. This can be avoided by considering potential new building works and monitoring nearby tree and hedge growth.

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Complaints Procedure

Williams Renewables Ltd is a member of 'Renewable Energy Consumer Code' and therefore subscribes to the RECC Assurance Scheme Consumer Code, incorporating the following complaints procedure;

This scheme has been set up with the intention of providing a means of complaint resolution that should be cheaper, faster and more effective than court action. Nothing in this Code prevents the consumer from seeking a legal remedy to their complaint, if they consider this to be the more appropriate action.
If a consumer wants to complain about the standard of service they have received, or about any other aspect of the contract, they should use the following procedure:

- the consumer must tell the member company he or she agreed the contract with about any complaint they have as soon as possible, and no later than three months, after they have first noticed the problem;
- as soon as reasonably possible after receiving the complaint, and at most within 20 working days from receiving the complaint, the member will arrange to inspect the system.
- where a consumer is without heating or hot water as a result of the situation that has led to the complaint, the member will arrange to inspect the system within 24 hours of receiving the complaint;
- the member will consider the details of the complaint and report the findings clearly to the consumer within seven working days from this inspection (if there is a possible safety issue arising from the complaint, the member will report back as a matter of urgency);
- the member will try to find an agreed course of action to resolve the complaint speedily and effectively to the consumer's satisfaction;
- if the consumer is not satisfied with the remedy offered by the member, they may notify the scheme administrator using this complaint form;
- the scheme administrator will log the complaint and acknowledge receipt of the notification within three days;
- the scheme administrator will contact the member to request a report on the situation;
- the scheme administrator will request the member to explain how they intend to resolve the complaint speedily and effectively;
- if a complaint cannot be sorted out through the above procedure, the member or consumer can use the conciliation service set out in section 9.2, below;
- members will not take action through the courts without first trying to solve the problem through the conciliation service, except in the way expressly set out in this section.

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The consumer may use a consumer representative or observer to help deal with a complaint. In this case, members must co-operate fully with this person. In the event that the complaint is of a technical nature the scheme administrator will seek the consumer's consent for the details to be shared with the relevant MCS certification body and the relevant trading standards department.

9.2 **Conciliation service**

The scheme offers a conciliation service that can be used in the unlikely event of complaints not being sorted out amicably between the two sides. This service aims to reach a non-legal solution to the dispute in a reasonable timescale. It is also available to trading standards departments, consumer advice centres, citizens' advice bureau and similar organisations to help them sort out any complaints involving a member. There is no extra charge for using this service. Members will always agree to use it if a consumer wants to do so. The conciliation process will work as follows:

- anyone wanting to use the service will enter the details of the matter on the conciliation form (they should then send the form to the scheme administrator;
- members should arrange for someone to help vulnerable consumers to fill in the form);
- within seven working days the scheme administrator will inform the other people identified in the form as being involved in the dispute;
- those people will send any relevant information to the scheme administrator as soon as possible, but in any event within 10 working days;
- the scheme administrator will appoint a suitably-qualified independent expert (or experts) to consider the matter (this person may or may not be linked to the panel);
- the independent expert will review the written evidence in the light of the consumer protection legislation in force, and may discuss the details and possible solutions with the people involved;
- if convenient for both parties, a face-to-face or 'proximity' mediation process will be arranged;

- after considering all the evidence, either written or from the mediation session, the expert will recommend what he or she believes to be a fair and workable resolution of the complaint;
- both sides will do their best to comply with the conciliator's recommendations which will be put into practice and the complaint closed without recourse to any further action;
- if the conciliator's advice is not acceptable to either side, they must explain why to the scheme administrator.

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9.3 **Independent arbitration**

In exceptional cases in which the conciliator's advice is not acceptable, either side has the right to ask for the matter to be referred to the independent arbitration service. Neither side is required to refer the dispute to independent arbitration, and may choose to deal with the matter in other ways, including taking legal action. However, if the consumer requests that the matter be referred for arbitration, the member must accede to the request.
The scheme administrator will appoint a suitably-trained independent expert (the 'independent arbitrator') to carry out the arbitration process. The arbitration process will work as follows:

- if possible, both sides should first have gone through the conciliation service (as described in section 9.2, above), though this is not an absolute requirement of the arbitration scheme;
- if a dispute is referred to the independent arbitrator, both will pay an initial fee equivalent to the County Court Fee (this fee will be refunded to the consumer if the independent arbitrator finds in his or her favour, or recommends it);
- the forms and other documents, including a summary report, from the conciliation process will be sent to the independent arbitrator;
- the independent arbitrator will give both sides the opportunity to provide evidence to back up their case and decide whether a site visit or product tests are required, and how they will be funded;
- any further costs will be explained to both sides and divided between them, as the independent arbitrator may decide;
- after considering all the evidence, the independent arbitrator will send the decision to both sides and the scheme administrator.

An award made under the independent arbitration service shall be final and binding on both the consumer and the member. They may only challenge it only on certain limited grounds under the Arbitration Act 1996. If the arbitrator makes a decision in favour of the consumer, the member must refund the fee in addition to any award that may be made.

[*Taken from The RECC Assurance Scheme Consumer Code, July 2010]*

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SECTION 4

Warranties

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Renewing Your Energy Options

Customer Warranty for Installation Services

This Warranty sets out the terms upon which Williams Renewables offers warranty cover for the Products supplied by it to its Customers, and for the installation services provided by Williams Renewables Registered Installers. Terms defined in Williams Renewables' Terms and Conditions bear the same meaning when used in this warranty. Your attention is drawn to Williams Renewables' Terms and Conditions, which includes provisions relevant to the warranty set out below.

1. Installation services

1.1 Williams Renewables warrants to the customer that the Installation Services will be performed by the appropriately qualified and trained Williams Renewables Registered Installers using reasonable care and skill, to such high standard of quality as it is reasonable for the Customer to expect.

1.2 The Warranty Period for the Installation Services shall be five years from completion of the Installation Services (as per signed date on WR-PV-PV Site Project Completion Form)

2. Remedial Action

2.1 Where a valid claim in Respect of the manner of performance of the Services is notified to the us in accordance with Williams Renewables 's Terms and Conditions, Williams Renewables may arrange for the relevant Products to be reinstalled by any of Williams Renewables ' Registered or approved Installers or, at Williams Renewables 's sole discretion, refund to the Customer the charge for the relevant part of the Installation Service (or a proportionate part of such charge), in which case Williams Renewables shall have no further liability to the customer.

3. Exceptions

3.1 This Warranty will not apply:

3.1.1 Unless the Product has been installed by a Williams Renewables Registered Installer and has been properly used and maintained throughout the Warranty Period.

3.1.2 Unless the Customer has informed Williams Renewables of the alleged defect within the Warranty Period and within a reasonable period of discovery.

4. General conditions

4.1 The Customer agrees that he will promptly provide all information and support including access to site and services) reasonably necessary to enable Williams Renewables to evaluate any alleged defect and to perform its obligations under this Warranty.

4.2 The Customer agrees that all premises, plant, power, fuel support services and other inputs that he is providing for the installation and use of the Products are reasonable, are fit for purpose and will be properly used and provided.

5. Expertise

5.1 Any dispute as to whether a defect is covered by this warranty shall be immediately referred at the request of either party to an independent expert whose identity has been agreed by both parties or in default of agreement within 14 days of referral then who shall be appointed by the President for the time being of the trade association or professional association that most closely affects the Products.

6. Third Party Rights

6.1 The benefit of this Warranty shall be exercisable by Williams Renewables' Customer or, in cases when the property to which a system has been installed is sold within the Warranty Period, to the new legal owner of the property. It may not be transferred to or exercised by any third party.

7. Law

7.1 This warranty shall be construed in accordance with English law and shall be subject to the

8. Manufacturer's Product Warranty

8.1 Most Products supplied by Williams Renewables come with the benefit of a manufacturer's product guarantee. Where a claim in respect of any of the Products is notified to Williams Renewables by a Customer in accordance with the Williams Renewables' Terms and Conditions, Williams Renewables will liaise with the manufacturer and use all reasonable endeavours to secure a replacement of the Product or the part in question) or (at the manufacturer's discretion) a refund of the price of the Product (or a proportionate part of the price), in which case Williams Renewables shall have no further liability to the Customer.

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Limited Warranty Certificate for REC Peak Energy Modules[1]

(valid as of September 1, 2011)

This Limited Warranty covers all modules with the REC Peak Energy name (as defined above) sold after September 1, 2011 and is valid in all member states of the European Union, the European Economic Area, countries belonging to the Eastern European Group[2] and further countries as listed below[3].

REC MODULES PTE. LTD. (hereafter the 'Warrantor' or 'REC') issues the following voluntary warranty to the end-user who purchased the Product in one of the states mentioned above and put the Product into use for the first time (the 'Original End-User'). In addition to the rights under this Limited Warranty, the Original End-User may be entitled to statutory warranty rights under applicable national laws which shall not be affected or limited in any way by this Limited Warranty.

I. Product Warranty

Subject to the terms and conditions of this Limited Warranty, REC warrants that the Products:

- Are free from defects in material and workmanship for a period of 10 years from the date of purchase by the Original End-User (not exceeding a maximum period of 10.5 years from the date of production as identified on the Product) (the 'Warranty Period') if installed and used in accordance with the installation instructions available to download from www.recgroup.com.
- Will remain safe and operational if cable and connector plugs are installed professionally and are not permanently positioned in water; provided however, that damage to the cable caused by abrasion on a rough surface due to insufficient fixing or to unprotected running of the cable over sharp edges is excluded. Damage caused by animals is also excluded.
- Will not experience freezing up of the aluminum frames if installed correctly.

The outer appearance of the Product, including scratches, stains, rust, mould, discoloration and other signs of normal wear and tear, which occurred after delivery or installation, do not constitute defects, provided the functionality of the Product is not affected. Glass breakage constitutes a defect only if not caused by any external influence.

If a defect occurs during the Warranty Period affecting the functionality of the Product, REC will, at its sole option:

- Repair the defective Product.
- Replace the Product with an equivalent product.
- Refund the current market price of an equivalent product at the time of the claim.

II. Power Output Warranty

Subject to the terms and conditions of this Limited Warranty, REC warrants that the actual power output of the Product will reach at least 97% of the nameplate power out specified on the Product during the first year (calculated from the date of production as identified on the Product). From the second year, the actual power output will decline annually by no more than 0.7% for a period of 24 years, so that by the end of the 25th year, an actual output of at least 80.2% of the nameplate power out specified on the Product will be achieved.

This Power Output Warranty covers only reduced performance due to natural degradation of the glass, the solar cell, the embedding foil, the junction box and interconnections under normal use.

If the Product does not reach the warranted power output levels set out above when measured by the Warrantor or by an independent measuring institute agreed to prior to testing by the Warrantor, under standard test conditions (IEC 61215) and taking into account a ±3% tolerance range, then REC will, at its sole option:

- Repair the Product
- Replace the Product with an equivalent product or to supply additional modules as necessary to achieve the warranted percentage of specified power output.
- Refund the current market price of an equivalent product at the time of the claim

III. Warranty Conditions, Limitations and Exclusions

1. This Limited Warranty is not transferable by the Original End-User, except to a subsequent owner of the solar power facility at which the Product was originally installed and remains installed, provided that this solar power facility has not been altered in any way or moved from the structure or property at which it was originally installed.

1 Excluding modules showing "Q3" as part of the product name.
2 As defined by the regional groups of Member States to the United Nations General Assembly (www.un.int).
3 This Limited Warranty also includes the countries of Andorra, Israel, Liechtenstein, Monaco, San Marino, Switzerland, Turkey and the Vatican City.

2. Notification of a warranty claim hereunder must be given without undue delay after detection of the defect and prior to the expiration of the applicable Warranty Period and in accordance with the procedure as set out in section IV below.
3. **Please note that this Limited Warranty does not cover, nor will the Warrantor reimburse, any on-site labor or other costs incurred in connection with the de-installation or removal of defective Products, transport or the re-installation of replaced or repaired Products or any components.**
4. The Warrantor may use remanufactured or refurbished parts or products when repairing or replacing any Products under this Limited Warranty. Any exchanged or replaced parts or Products will become the property of REC. The Warranty Periods set out in sections I. and II. above will not be extended in any way in the event of a replacement or repair of a Product.
5. This Limited Warranty requires that the Product is installed according to the latest safety, installation and operation instructions provided by REC and does not apply to damage, malfunction, power output or service failures which have been caused by: (a) repair, modifications or removal of the Product by someone other than a qualified service technician; (b) any improper attachment, installation or application of the Product or (c) abuse, misuse, accident, negligent acts, power failures or surges, lightning, fire, flood, accidental breakage, actions of third parties and other events or accidents outside REC's reasonable control and/or not arising under normal operating conditions.
6. This Limited Warranty is provided voluntarily and free of charge and does not constitute an independent guarantee promise. Therefore, if any defect materially affects the functionality of the Product or results in a power output below the warranted levels, the Original End-User's remedies are limited exclusively to the remedies set out under sections I. and II. in the warranty cases specified herein. REC assumes no warranties, express or implied, other than the warranties made herein and specifically disclaims all other warranties, merchantability or fitness for a particular purpose. REC excludes all liabilities for any special, incidental, consequential or punitive damages from the use or loss of use of the Products to perform as warranted; including but not limited to damages for loss of power, lost profits or savings nor expenses arising from third-party claims. This does not apply to the extent the Warrantor is liable under applicable mandatory product liability laws or in cases of intent or gross negligence on the part of the Warrantor.
7. This Limited Warranty shall be governed by and construed in accordance with the laws of Germany irrespective of its choice of law principles. The United Nations Convention on Contracts for the International Sale of Goods (1980) shall not apply to or govern this Limited Warranty or any aspect of any dispute arising there from. REC hereby irrevocably submits to the jurisdiction of the courts of Germany for the determination of any disputes arising under this Limited Warranty.

IV. Warranty Claim Procedure

Claims under this Limited Warranty must be made by notifying the authorized distributor or seller where the Product was first purchased. A claim may be registered at:

www.recgroup.com/warranty

For a Warranty Claim to be processed, proof of the original purchase of the Product and any subsequent sales including transfer of this Warranty need to accompany the claim. The claim must include a description of the alleged defect(s) as well as the Product's serial number(s). Prior to returning any Products or components to REC, an RMA (Return Merchandise Authorization) number is required, which may be obtained by contacting REC via the aforesaid address.

This warranty is valid for Products sold on or after September 1, 2011.

****

SMA Solar Technology AG | Sonnenallee 1 | 34266 Niestetal | Germany
Phone: +49 561 9522-0 | Fax: +49 561 9522-100 | Internet: www.SMA.de | E-mail: info@SMA.de
Register court: Amtsgericht Kassel HRB 3972

SMA Factory Warranty

Applies solely to the following products: Sunny Boy, Windy Boy, Sunny Mini Central, Sunny Tripower, Sunny Boy Control (Light, Plus), Sunny Beam, Sunny WebBox, Sunny Matrix, Sunny Sensor Box, Power Reducer Box, PV Offset Box.

The legal guaranty obligation of the seller of your device is not affected by this warranty and remains fully valid for 24 months from the date of delivery.

For the above named products, you receive an SMA factory warranty valid for 5 years from the date of purchase. The SMA factory warranty covers any costs which you incur for repair or replacement parts during the agreed period beginning at the date of purchase of the device, subject to the conditions listed below. This is not associated with a durability warranty.

You have the possibility of purchasing an extension of this SMA factory warranty within the 5 year term of the SMA factory warranty, this does not apply for the PV Offset Box. The prices are based on the respective SMA price list valid at the time the warranty extension was signed.

Warranty Conditions

If a device becomes defective during the agreed SMA factory warranty period and provided that it will not be impossible or unreasonable, the device will be, as selected by SMA,

- repaired by SMA, or
- repaired on-site, or
- exchanged for a replacement device of equivalent value according to model and age.

In the latter case, the remainder of the warranty entitlement will be transferred to the replacement device. In this case, you do not receive a new certificate since your entitlement is documented at SMA.

Excessiveness in the meaning above exists in particular if the cost of the measures for SMA would be unreasonable

- in view of the value that the device would have without the defect,
- taking into account the significance of the defect, and
- after consideration of alternative workaround possibilities that SMA customers could revert to without significant inconvenience.

The factory warranty includes the costs of SMA for work and material for the restoration of faultless functioning in SMA's factory or for on-site repair work by SMA personnel. All other costs, particularly shipping costs, travel, and accommodation costs of SMA personnel for on-site repairs as well as costs of the customer's own employees are not included in the factory warranty.

With the installation of devices for private use by natural persons in the EU region, Switzerland, Australia, China, Korea, Croatia, New Zealand, Norway and the US, the factory warranty also includes shipping costs or travel and accommodation costs of SMA service personnel for on-site repairs.

If this point of installation is located outside the above mentioned countries or in overseas locations of these countries, no shipping, travel, or accommodation costs will be borne.

To determine the warranty entitlement, please submit a copy of the purchasing invoice or a copy of the warranty certificate, if necessary including the receipt of the warranty extension. The type plate on the device must be completely legible. Otherwise, SMA is entitled to refuse to provide warranty services.

Please report defective devices with a brief error description to our SMA Serviceline. If we agree to a replacement, we generally send an equivalent replacement device, packaged appropriately for transport, within 2 working days. The defective device is to be packed in this transport packaging for return transport to SMA. All warranty services are free of charge only if the course of action was agreed with SMA in advance.

Scope of the Factory Warranty

The factory warranty does not cover damages that occur due to the following reasons:

- Transport damage
- Incorrect installation or commissioning
- Failure to observe the user manual, the installation guide, and the maintenance regulations
- Modifications, changes, or attempted repairs
- Incorrect use or inappropriate operation
- Insufficient ventilation of the device
- Failure to observe the applicable safety regulations (VDE standards, etc.)
- Force majeure (e.g., lightning, overvoltage, storm, fire)

Neither does it cover cosmetic defects which do not influence the energy production.

Claims that go beyond the rights cited in the warranty conditions, in particular claims for compensation for direct or indirect damages arising from the defective device, for compensation for costs arising from disassembly and installation, or loss of profits are not covered by the factory warranty, insofar SMA is not subject to statutory liability. In such cases, please contact the company that sold you the device. Possible claims in accordance with the law on product liability remain unaffected.

All claims arising from or in connection with this warranty are subject to German law. Kassel, Germany is the exclusive place of jurisdiction for all disputes arising from or in connection with this warranty

SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal, Germany

SMA Serviceline

SMA Service Europe

Germany
SMA Solar Technology AG

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Sunny Island	Tel +49 561 9522-399	Fax +49 561 9522-4697

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www.SMA.de

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SMA Service Australia

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SMA Technology Australia PTY Ltd.
Tel +61 2 9669 2889
Fax +61 2 9669 2887
Service@SMA-Australia.com.au
www.SMA-Australia.com.au

SECTION 5

System Commissioning Documents

Williams Renewables
59a Red Lion Street
London WC1R 4PD

020 3542 2315
info@williamsrenewables.com
www.williamsrenewables.com

ELECTRICAL INSTALLATION CERTIFICATE
BS 7671:2008 – single signature

Certificate number: 48

Registration number: 60056 (optional)

DETAILS OF CLIENT:

Apex Traders Ltd.....
91-93 Baker St, ...
London.....
W1H 6QQ.....
.....

INSTALLATION ADDRESS:

2C Wilmot Place, London, NW1 9JS .....
.....
.....
.....

JOB NUMBER (optional)

N/A

Sheet 1 of 4

DESCRIPTION AND EXTENT OF INSTALLATION COVERED BY THIS CERTIFICATE

Electrical install for SOLAR PV SYSTEM

.....
.....

New installation N/a Addition ✓ Alteration N/a

FOR DESIGN, CONSTRUCTION, INSPECTION AND TEST

I/We being the person responsible for design, construction, inspection and testing of the electrical installation (as indicated by my signature below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design, construction, inspection and testing, hereby CERTIFY that the said work for which I/we have been responsible is, to the best of my knowledge and belief, in accordance with BS 7671:2008 as amended to . 2011 ... except for the departures, if any, detailed as follows:

Departures and comments on existing installations (120.3; 133.5) . NONE .....
.....
.....
.....

Name . Y. Khreptovich .....
For . Eco Fortis Ltd .....
Position . Electrician .....
Signature . .....
Date . 04/06/2015.....
Next Inspection. 04/06/22016.....

I/We recommend that the installation be further inspected and tested after an interval of not more than . 10 .... years.

SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS

Nominal voltage U/Uo . 400 V
Prospective fault current, Ipf . 1.67 ..... kA
Frequency F 50 Hz
External loop impedance, Ze . 0.10.. Ohms
Alternative source of supply N/a a.c. ✓ d.c. N/a

Number and type of live conductors

N/a 1-phase, 2-wire
✓ 3-phase, 3-wire
N/a 3-phase, 4-wire

Supply protective device characteristics

Type/BS (EN) .1361/II .....
Rated Current . 100 ..... A

Earthing arrangements

✓ TN-S
N/a TN-C-S
N/a TT
Other . N/a.....

Distributor's facility ✓
Installation earth electrode N/a
Type . N/a..... (Rod, plate, tape, etc.)
Location . N/a.....
Resistance . N/a..... Ohms

PARTICULARS OF INSTALLATION REFERRED TO IN THIS CERTIFICATE

Maximum demand

kVA / Amps

100 .....

Main switch or circuit breaker

BS . 60947 Current rating .100... A
Type . 3 No. of poles .....2.
Location . Cupboard in the porch.....
Voltage 230 Fuse rating N/a
Rating . N/a V or setting . .....N/a... A
RCD trip time N/a. ms RCD $1_{\Delta n}$. N/a mA

(Applicable only where RCD is suitable and is used as a main circuit breaker)

Location of main protective bonding connections

Gas- garage
Water- basement
Gas- basement.....
.....
.....

Earthing conductor

✓ Copper
N/A Steel
N/A Aluminium

Main protective conductors

CSA . 16 ..... mm^2 Connections verified ✓

Main protective bonding conductor

✓ Copper
N/A Steel
N/A Aluminium

CSA . 10 ..... mm^2 Connections verified ✓

Main bonding:
Water ✓ Gas ✓ Other N/a

SCHEDULE OF INSPECTIONS

NOTES:

✓ to indicate an inspection has been carried out and the result is satisfactory
N/A to indicate that the inspection is not applicable to a particular item

NOTE – items on the right are seldom relevant in a domestic setting

METHODS OF PROTECTION AGAINST ELECTRIC SHOCK

Basic protection:

- ✓ (i) Insulation of live parts
- ✓ (ii) Barriers or enclosures

Fault protection:

(i) Automatic disconnection of supply:

- ✓ Presence of earthing conductor
- ✓ Presence of circuit protective conductors
- ✓ Presence of protective bonding conductors
- N/A Presence of supplementary bonding conductors
- ✓ Choice of setting of protective and monitoring devices (for fault and/or overcurrent protection)

Additional protection:

- ✓ Presence of residual current device(s)
- N/a Presence of supplementary bonding conductors

PREVENTION OF MUTUAL DETRIMENTAL INFLUENCE

- ✓ (a) Proximity to non-electrical services and other influences
- N/a (b) Segregation of Band I and Band II circuits or use of Band II insulation

IDENTIFICATION

- ✓ (a) Presence of diagrams, instructions, circuit charts and similar information
- ✓ (b) Presence of danger notices and other warning notices
- ✓ (c) Labelling of protective devices, switches and terminals
- ✓ (d) Identification of conductors

CABLES AND CONDUCTORS

- ✓ Selection of conductors for current-carrying capacity and voltage drop
- ✓ Erection methods
- ✓ Routing of cables in prescribed zones
- N/a Cables incorporating earthed armour or sheath, or run within an earthed wiring system, or otherwise adequately protected against nails, screws and the like

CABLES AND CONDUCTORS (continued)

- ✓ Additional protection provided by 30 mA RCD for cables concealed in walls (where required in premises not under the supervision of a skilled or instructed person)
- ✓ Connection of conductors
- ✓ Presence of fire barriers, suitable seals and protection against thermal effects

GENERAL

- ✓ Presence of correct location of appropriate devices for isolation and switching
- ✓ Adequacy of access to switchgear and other equipment
- ✓ Particular protective measures for special installations and locations
- ✓ Connection of single-pole devices for protection or switching in line conductors only
- N/a Correct connection of accessories and equipment
- N/a Selection of equipment and protective measures appropriate to external influences
- N/a Selection of appropriate functional switching devices

ADDITIONAL SCHEDULE OF ITEMS INSPECTED (where applicable)

- N/a SELV
- N/a PELV
- ✓ Double insulation
- ✓ Reinforced insulation
- N/a Obstacles
- N/a Placing out of reach
- N/a Presence of earthing arrangements for combined protective and functional purposes
- ✓ Presence of adequate arrangements for alternative source(s), where applicable
- N/a FELV
- N/a Absence of protective conductors
- N/a Presence of earth-free local equipotential bonding
- ✓ Electrical separation provided for **one item** of current-using equipment
- N/a Electrical separation provided for **more than one item** of current-using equipment
- ✓ Segregation of safety circuits
- N/a Presence of undervoltage protective devices

SCHEDULE OF TEST RESULTS

DB Reference no. . DB2 .....
Location . cupboard on the staircase (top floor).....
Zs at DB (Ω) . 0.12 .....
I_{pf} at DB (kA) . 1.69 .....
Correct polarity of supply confirmed YES / NO
Phase sequence confirmed (where appropriate) N/a

Details of circuits and/or installed equipment vulnerable to damage when testing
NONE.....
.....
.....
.....
.....

Details of test instruments used (state serial and/or asset numbers) Contin
uity . 101306959.....
Insulation resistance . --------//-------.....
Earth fault loop impedance . -------//--------.....
RCD . -------//--------.....
Earth electrode resistance . N/a.....

Tested by:
Name (CAPITALS). **Y.Khreptovich** .....
Signature.  ..... **Date** **..04/06/2015.**

Circuit details

		Overcurrent device				Conductor details		
Circuit number	Circuit description	BS (EN)	Type	Rating (A)	Breaking capacity (kA)	Reference method	Live (mm^2)	cpc (mm^2)
A	B	C	D	E	F	G	H	I
1	Solar PV	60898	B	16	6	B	2.5	1.5

Test results

Ring final circuit continuity (Ω)			Continuity (Ω) (R_1 + R_2) or R_2		Insulation resistance (MΩ)		Polarity	Z_s (Ω)	RCD (ms)			Remarks (continue on a separate sheet if necessary)
r_1 (line)	r_n (neutral)	r_2 (cpc)	(R_1 + R_2) *	R_2	Live – Live	Live – E	✓	Ω	@$I_{\Delta}n$	@5$I_{\Delta}n$	Test button operation	
J	K	L	M	N	O	P	Q	R	S	T	U	V
n/a	n/a	n/a	n/a	0.10	>999	>999	✓	0.121	n/a	n/a	n/a	

* Where there are no spurs connected to a ring final circuit this value is also the (R_1 + R_2) of the circuit.

ELECTRICAL INSTALLATION CERTIFICATE NOTES:

1 The Electrical Installation Certificate is to be used only for the initial certification of a new installation or for an addition or alteration to an existing installation where new circuits have been introduced.

It is not to be used for a Periodic Inspection, for which an Electrical Installation Condition Report form should be used. For an addition or alteration which does not extend to the introduction of new circuits, a Minor Electrical Installation Works Certificate may be used.

The 'original' Certificate is to be given to the person ordering the work (Regulation 632.1). A duplicate should be retained by the contractor.

2 This Certificate is only valid if accompanied by the Schedule of Inspections and the Schedule(s) of Test Results.

3 The signatures appended are those of the persons authorised by the companies executing the work of design, construction and inspection and testing respectively. A signatory authorised to certify more than one category of work should sign in each of the appropriate places.

4 The time interval recommended before the first periodic inspection must be inserted (see IET Guidance Note 3 for guidance).

5 The page numbers for each of the Schedules of Test Results should be indicated, together with the total number of sheets involved.

6 The maximum prospective value of fault current (I_{pf}) recorded should be the greater of either the prospective value of short-circuit current or the prospective value of earth fault current.

7 The proposed date for the next inspection should take into consideration the frequency and quality of maintenance that the installation can reasonably be expected to receive during its intended life and the period should be agreed between the designer, installer and other relevant parties.

ELECTRICAL INSTALLATION CERTIFICATE GUIDANCE FOR RECIPIENTS

(to be appended to the Certificate)

This safety Certificate has been issued to confirm that the electrical installation work to which it relates has been designed, constructed, inspected and tested in accordance with British Standard 7671 (the IET Wiring Regulations).

You should have received an 'original' Certificate and the contractor should have retained a duplicate. If you were the person ordering the work, but not the owner of the installation, you should pass this Certificate, or a full copy of it including the schedules, immediately to the owner.

The 'original' Certificate should be retained in a safe place and be shown to any person inspecting or undertaking further work on the electrical installation in the future. If you later vacate the property, this Certificate will demonstrate to the new owner that the electrical installation complied with the requirements of British Standard 7671 at the time the Certificate was issued. The Construction (Design and Management) Regulations require that, for a project covered by those Regulations, a copy of this Certificate, together with its schedules, is included in the project health and safety documentation.

For safety reasons the electrical installation will need to be inspected at appropriate intervals by a competent person. The maximum time interval recommended before the next inspection is stated on Page 1 under 'Next Inspection'.

This Certificate is intended to be issued only for a new electrical installation or for new work associated with an addition or alteration to an existing installation. It should not have been issued for the inspection of an existing electrical installation. An 'Electrical Installation Condition Report' should be issued for such an inspection.

DC ARRAY TEST REPORT

Array Test Report – D.C. circuits

Job Reference No: 5409	**Contractor Name and Address:**
Installation address: **2C Wilmot Place** **London** **NW1 9JS**	**Williams Renewables Ltd** **59a Red Lion Street** **London** **WC1R 4PD**
Test Date: **04/06/15**	**Signature:** 
Description of work under test: Solar PV	**Test Instruments** MBEIC45107

String Number		1		
Array	Module	REC REC250PE		
	Quantity	6		
Array Parameters	Voc (stc)	224.4V		
	Isc (stc)	8.86A		
Protective device	Type	N/A		
	Rating (A)	N/A		
	d.c. Rating (V)	N/A		
	Capacity (kA)	N/A		
String test Method: Annex-2	Voc (V)	211.5V		
	Isc (I)	5.3A		
	Sun	75		
Polarity Check		Yes		
Earth Continuity (where fitted)		N/A		
Inverter Serial No.		2007349285		
Array insulation resistance Test Method: Annex-1	Test voltage (V)	500V		
	Pos – Earth (MΩ)	>999		
	Neg – Earth (MΩ)	>999		
Comments				

PV system - Installation Check List

General installation (electrical – ref IEC60364-6-61)
- ✓ Equipment compliant with standards, correctly selected & not damaged
- ✓ Equipment accessible for operation, inspection & maintenance
- ✓ Equipment and accessories correctly connected
- ✓ Particular protective measures for special location
- ✓ Equipment and protective measures appropriate to external influences
- ✓ System installed to prevent mutual detrimental influence
- ✓ Conductors connected and identified
- ✓ Conductors selected for current carrying capacity and voltage drop
- ✓ Conductors routed in safe zone or protected against mechanical damage
- ✓ Presence of fire barriers, seals and protection against thermal effects

General installation (mechanical)
- ✓ Ventilation provided behind array to prevent overheating / fire risk
- ✓ Array frame & material corrosion proof
- ✓ Array frame correctly fixed and stable; Roof fixings weatherproof
- ✓ Cable entry weatherproof

Protection against overvoltage / electric shock
- ✓ Live parts insulated, protected by barrier / enclosure, placed out of reach or Class II
- N/A Array frame equipotential bonding present (only relevant if required)
- N/A Surge protection devices present (only relevant if required)
- ✓ RCD provided (only relevant if required)
- N/A Frame correctly integrated with existing LPS installation

D.C. system
- ✓ Physical separation of A.C and D.C. cables
- ✓ D.C. switch disconnector fitted (to IEC60364-712.536.2.2)
- N/A D.C. cables - protective and reinforced insulation (only relevant if required)
- ✓ All D.C. components rated for operation at max D.C. system voltage (Voc stc x 1.25)
- N/A PV strings fused or blocking diodes fitted (only relevant if required)

A.C. system
- ✓ A.C. isolator lockable in off position only
- ✓ Inverter protection settings to local regulations

Labelling & identification
- ✓ General labelling of circuits, protective devices, switches and terminals (to IEC60364-6-61)
- ✓ PV system schematic displayed on site
- ✓ Protection settings & installer details displayed on site
- ✓ Emergency shutdown procedure displayed on site
- ✓ A.C. isolator clearly labelled
- ✓ D.C. isolator / junction boxes suitably labelled
- ✓ Signs & labels suitably affixed and durable

Field insulation test procedure
Safety:

- Read and make sure you understand this procedure before you start any work.
- Insulation testing is an electric shock hazard - use caution when performing the testing.
- Do not perform the test before you have received practical training.
- Limit the access to the working area.
- Do not touch and take measures to prevent any other persons to touch any metallic surface with any part of your body when performing the insulation test.
- Do not touch and take measures to prevent any other persons to touch the back of the module/laminate or the module/laminate terminals with any part of your body when performing the insulation test.
- Whenever the Insulation test device is energised there is voltage on the testing area. The equipment is to have to have automatic auto-discharge capability.

NOTE REGARDING TEST METHOD

- Two test methods are possible:
    1) Test between Array Negative and Earth followed by a test between Array Positive and Earth
    2) Test between Earth and short-circuited Array Positive & Negative
- Where the structure/frame is bonded to earth, the earth connection may be to any suitable earth connection or to the array frame (where the array frame is utilised, ensure a good contact and that there is continuity over the whole metallic frame).
- For systems where the array frame is not bonded to earth (eg where there is a class II installation) a commissioning engineer may choose to do two tests: i) between Array cables and Earth and an additional test ii) between Array cables and Frame.
- For Arrays that have no accessible conductive parts (eg PV roof tiles) the test should be between Array cables and Building Earth

Test Zone Preparation:
1) Limit access to non-authorized personnel.
2) Isolate the PV array from the inverter (typically at the array switch disconnector)
3) Disconnect any piece of equipment that could have impact on the insulation measurement (i.e. overvoltage protection) in the junction or combiner boxes.

Equipment Required:

- Insulation resistance test device
- Insulation gloves
- Goggles.
- Safety boots.
- Short-circuit box (if required)

Procedure

1) The test should be repeated for each Array as minimum. It is also possible to test individual strings if required.
2) Wear the safety shoes, gloves and goggles.
3) Where the test is to be undertaken between Earth and short-circuited Array positive and Array negative cables - short-circuit the cables with an appropriate short-circuit junction box.
4) Connect one lead from the Insulation Resistance test device to the array cable(s) as per the NOTE above.
5) Connect the other lead from the Insulation Resistance device to Earth as per NOTE above
6) Secure all the test leads (eg with cable ties).
7) Follow Insulation Resistance Test Device instructions to ensure the test voltage is according to table 1 and readings in M Ohms.
8) Follow Insulation Resistance Test Device instructions to perform the test.
9) Ensure system is de-energised before removing test cables or touching any conductive parts.

Table 1

Test method	System Voltage (Voc stc x 1.25)	Test voltage	Minimum Impedance
Array positive and negative shorted together	120V	250V	0.25 MΩ
	<600V	500V	0.5 MΩ
	<1000V	1000V	1 MΩ
Separate tests to Array positive and Array negative	120V	250V	0.25 MΩ
	<600V	500 – Voc stc (min. 100V)**	0.5 MΩ
	<1000V	1000 – Voc stc (min 100V)**	1 MΩ

** Test voltage adjusted to prevent peak voltage exceeding module or cable rating

G83/2 Appendix 3 SSEG Installation Commissioning Confirmation

G83/2 SSEG INSTALLATION COMMISSIONING CONFIRMATION In accordance with ESQCR and HSE Certificate of Exemption (2008) (see Appendix 6) the Installer is required to advise the DNO of the intention to use the SSEG in parallel with the network no later than 28 days (inclusive of the day of commissioning), after commissioning the SSEG	
Email	G83Notification@ukpowernetworks.co.uk ***or***
Fax	01293 577 760 ***or***
Post	Distributed Generation Notifications, UK Power Networks Ltd, Fore Hamlet, Ipswich, Suffolk, IP3 8AA

SSEG installation address details	
Name of Customer at Site	Oliver and Isabelle Wolf
Customer contact telephone	Unknown
Site address	2C Wilmot Place London
Post Code	NW1 9JS
MPAN	12 0006 1685 834

SSEG owner if different from above	
Name and Contact Address Including Post Code	
Contact telephone number	

SSEG Details

Note only technologies with Type Tested equipment can be installed under G83/2.

Capacities	phase 1 in kW	phase 2 in kW	phase 3 in kW	Type test ref only for new installations	Primary energy source. Eg Wind, Solar PV, Hydro, Gas CHP.
New	1.5			G83/2	Solar PV
New/Existing					
New/Existing					

The Maximum aggregate capacity of SSEGs installed in a **single** customer's installation under **G83/2 is 3.68kW per phase at 230V AC**.

Identify above new SSEG installations and existing installations at the site which have not been de-commissioned as of the date of this declaration. Use a separate line for new and existing installations and for different Primary Energy sources above. For installations above 3.68kW per phase the separate G59 process applies and the DNO needs to be consulted before any installation is undertaken. Use ph 1 column for single phase supply

I confirm that the new SSEGs noted above has/have been installed and commissioned to comply with the requirements of **G83/2** as required by The Distribution Code. I enclose a copy of the circuit diagram which has been left on site at the customers incoming meter location.

Name	Rob Williams	Signed		Date	04.06.2015

On behalf of Installer	Williams Renewables Ltd
Accreditation / Qualification	NIC2373
Installer address	The Studios, 22 Gloucester Street Cirencester Gloucestershire
Post code	GL7 2DG
Contact person	Rob Williams
Telephone number	020 3542 2315
Email address	rob@williamsrenewables.com

Information to be enclosed:

1. Final copy of circuit diagram – see attached
2. SSEG Test Report (Appendix 4) or web address if appropriate (not necessary if already provided e.g. under a Stage 2 connection) – see attached
3. Computer print our (where possible) or other schedule of protection settings – on schematic
4. Electricity meter(s) make and model – Elster A100C

MCS Installation Certificate No. MCS-00801553-M

Version 1

Thursday, 04 June 2015 17:42:54

INSTALLER DETAILS

MCS Certificated Installation Company Name and MCS number:

Williams Renewables Ltd (NIC2373)

SITE DETAILS

Address:
FLAT C-2
(1-2)
WILMOT PLACE
LONDON
NW1 9JS

Supply MPAN: 1200061685834

GENERATION METER DETAILS

Generation Meter Make(s):

Elster

Generation Meter Model(s):

A100C

Generation Meter Serial Number(s) (MSN):

14117053

Generation Meter Reading(s):

0.6

(at commissioning date)

INSTALLATION DETAILS

Commissioning Date: 04/06/2015

Total Installed Capacity (kW): 1.50

Declared Net Capacity (kW): 1.50

Estimated Annual Generation (kWh): 1418.00

Green Deal Installation: No

Installation Type: Non-Standalone

Planning Regulations Compliance:

Permitted Development Rights (PDR)

Building Regulations Notification:

After the installation through a self certification Competent Persons Scheme (CPS)

PRODUCT DETAILS

Technology Type:

SOLAR PHOTOVOLTAIC

MCS Certificated Product Name:

REC xxx PE (205W - 285W) in 5W increments

MCS Certificated Product Manufacturer:

REC Solar AS

MCS Certificated Product Number:

BBA0044/01

williams renewables
Renewing Your Energy Options

Professional Accreditations

Williams Renewables is a member of the following schemes and organisations:

NICEIC
Warwick House
Houghton Hall Park
Houghton Regis
Dunstable LU5 5ZX

Microgeneration Certificate Scheme
10 Fenchurch Street
London
EC3M 3BE

HETAS
Orchard Business Centre
Stoke Orchard
Cheltenham
Gloucestershire
GL52 7RZ

Renewable Energy Consumer Code
17 Waterloo Place
London
SW1Y 4AR

iwa.biz Workmanship Insurance
20 Billing Road
Northampton
NN1 5AW