Certificate of compliance

Applicant:	**IMEON ENERGY** 10 Rue Amiral Romain Desfosses 29200 Brest **France**
Product:	**Inverter**
Model:	**IMEON 3.6**

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with EN 50438:2013 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

Applied rules and standards:

EN 50438:2013, CYS EN 50438:2013
Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks

DIN V VDE V 0126-1-1:2006-02 (Functional safety)
Automatic disconnection device between a generator and the public low-voltage grid

At the time of issue of this certificate the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.

Report number:	**PV171127N015-R1**
Certificate number:	**U18-515**
Date of issue:	**2018-09-17**

Certification body

DAkkS
Deutsche
Akkreditierungsstelle
D-ZE-12024-01-00

Holger Schaffer
Certification body of Bureau Veritas Consumer Products Services Germany GmbH
Accredited according to DIN EN ISO/IEC 17065

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-R1**

Type Approval and declaration of compliance with the requirements of EN 50438.	
Manufacturer / applicant:	IMEON ENERGY 10 Rue Amiral Romain Desfosses 29200 Brest France
Micro-generator Type	Inverter
Rated values	IMEON 3.6
Maximum rated capacity	3000VA
Rated voltage	230Vac, 50Hz
Firmware version	00
Measurement period:	2017-11-27 to 2018-09-03

Description of the structure of the power generation unit (Figure 1):

The power generation unit is equipped with a PV and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.

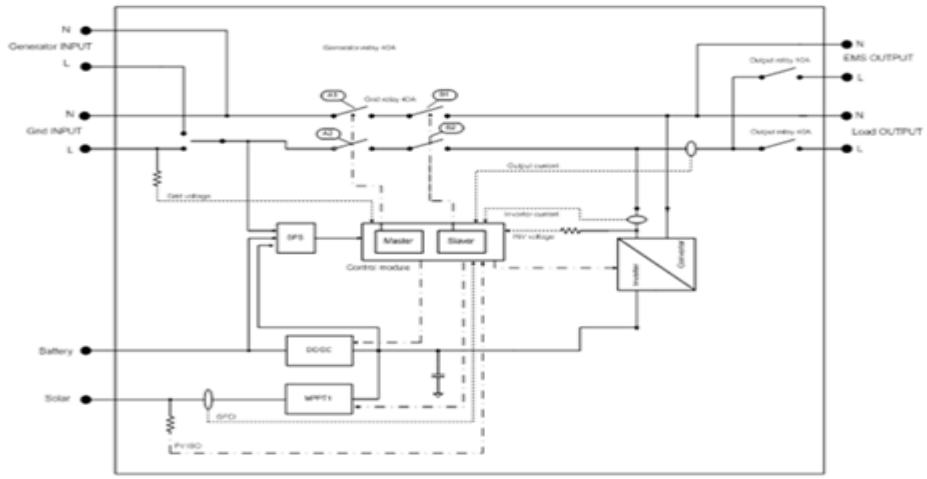

Figure 1 – Schematic structure of the power generation unit

The above stated micro-generators are tested according to the requirements in the EN 50438. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the EN 50438.

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Type testing of the interface protection

Over-/under-voltage tests						
Parameter	**Protection limit**		**Actual setting**		**Trip value (test result)**	
	Voltage [V]	**Disconnection time [s]**	**Voltage [V]**	**Disconnection time [s]**	**Voltage [V]**	**Disconnection time [s]**
Over-voltage stage 1	253,0	0,5	253,0	0,5	207,0	0,073
Under-voltage stage 1	207,0	0,5	207,0	0,5	253,0	0,075
Note. Minimum operation time according to default interface protection: Over-voltage stage 1 0,5 Under-voltage 0,5						

Over-/under-frequency tests						
Parameter	**Protection limit**		**Actual setting**		**Trip value (test result)**	
	Frequency [Hz]	**Disconnection time [s]**	**Frequency [Hz]**	**Disconnection time [s]**	**Frequency [Hz]**	**Disconnection time [s]**
Over-frequency	52,0	0,5	52,0	0,5	52,03	0,440
Under-frequency	47,0	0,5	47,0	0,5	46,99	0,393
Note. Minimum operation time according to default interface protection: Over-frequency 0,5 s Under-frequency 0,5 s						

LoM test						
Method used	**EN 62116**					
Balancing load on islanded network	**33% of -5% Q Test 22**	**66% of -5% Q Test 12**	**100% of -5% P Test 5**	**33% of +5% Q Test 31**	**66% of +5% Q Test 21**	**100% of +5% P Test 10**
Trip time. Phase 1 fuse removed [ms]	150	224	253	69	73	297

Appendix E Type Verification Test Report	
Extract from test report according to EN 50438	Nr. PV171127N015-R1

Type testing of a micro-generator

Operating range

Test 1: U = 195,5 V; f = 47,5 Hz; P = 1,00 Sn; cosφ = 1
Test 2: U = 253,0 V; f = 51,5 Hz; P = 1,00 Sn; cosφ = 1

Test sequence	Voltage [V]	Frequency [Hz]	Output power [W]	Cos φ [1]
1	195,6	47,50	2,988	0,9995
2	253,1	51,50	2,996	0,9998

Active power at under-frequency			
5-min mean value (each)	a) 50 ± 0,01 [Hz]	b) - 0,4 to – 0,5 [Hz]	c) - 2,4 to - 2,5 [Hz]
Frequency [Hz]:	50,00	49,50	47,55
Active power [kW]:	2,990	2,990	2,970
ΔP/PM [%] per 1 Hz:			<0,67

Power response to over-frequency							
1-min mean value [Hz]:	a) 50,00	b) 50,25	c) 50,70	d) 51,15	e) 50,70	f) 50,25	g) 50,00
1. Measurement a) to g): Active power output > 80% Pn							
Frequency [Hz]:	50,00	50,25	50,70	51,15	50,70	50,25	50,00
PM [kW]:	N/A	2,929	2,391	1,853	2,391	2,929	N/A
PE60 [kW]:	2,989	2,960	2,429	1,916	2,397	2,911	2,990
ΔPE60/PM [%]:	N/A	1,03	1,26	2,09	0,19	-0,61	N/A
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% Pn							
Frequency [Hz]:	50,00	50,25	50,70	51,15	50,70	50,25	N/A
PM [kW]:	N/A	1,473	1,202	0,932	1,202	1,473	N/A
PE60 [kW]:	1,503	1,492	1,236	0,977	1,223	1,482	N/A
ΔPE60/PM [%]:	N/A	0,64	1,12	1,50	0,69	0,30	N/A
Limit ΔP/P1min:	+ 10 % of P_M						

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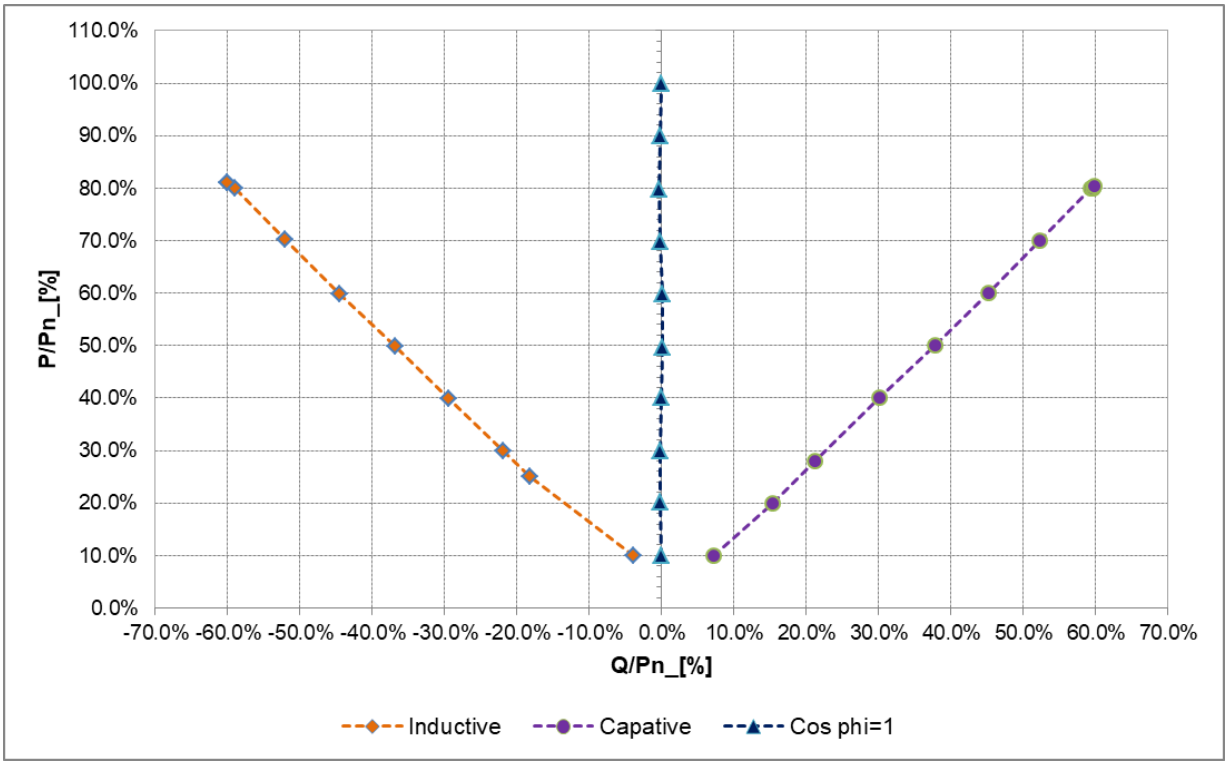
Reactive power			
Uncontrollable reactive power			
Test Voltage / Output power	**211,6V**	**230V**	**248,4V**
25% PN	0,998i	0,999i	0,999i
50% PN	0,999i	0,999i	0,999i
75% PN	0,999i	0,999i	0,999i
100% PN	0,999i	0,999i	0,999i
Limit	**>0,95**	**>0,95**	**>0,95**

Controllable reactive power				
Inductive (supply reactive power)				
Power-BIN	**Active power [W]**	**Reactive power [Var]**	**Power factor (cos φ)**	**DC power [kW]**
0% - 10%	0,298	-0,118	0,9026	0,352
10% - 20%	0,754	-0,546	0,8098	0,826
20% - 30%	0,897	-0,658	0,8063	0,974
30% - 40%	1,198	-0,882	0,8053	1,288
40% - 50%	1,498	-1,106	0,8044	1,602
50% - 60%	1,795	-1,335	0,8026	1,916
60% - 70%	2,104	-1,561	0,8030	2,243
70% - 80%	2,398	-1,769	0,8047	2,558
80% - 90%	2,429	-1,801	0,8033	2,594
90% - 100%	2,429	-1,801	0,8032	2,592
Capacitive (supply reactive power)				
Power-BIN	**Active power [W]**	**Reactive power [Var]**	**Power factor (cos φ)**	**DC power [kW]**
0% - 10%	0,300	0,217	0,8104	0,352
10% - 20%	0,598	0,458	0,7941	0,659
20% - 30%	0,839	0,636	0,7968	0,908
30% - 40%	1,201	0,903	0,7992	1,284
40% - 50%	1,500	1,134	0,7977	1,597
50% - 60%	1,798	1,357	0,7982	1,911
60% - 70%	2,101	1,569	0,8011	2,231
70% - 80%	2,397	1,779	0,8030	2,546
80% - 90%	2,400	1,787	0,8020	2,556
90% - 100%	2,413	1,796	0,8022	2,568
Reactive power supply with set point Q=0				
Power-BIN	**Active power [W]**	**Reactive power [Var]**	**Power factor (cos φ)**	**DC power [kW]**
0% - 10%	0,299	-0,004	0,9999	0,352
10% - 20%	0,602	-0,004	0,9999	0,664
20% - 30%	0,896	-0,008	0,9999	0,968
30% - 40%	1,202	0,000	0,9999	1,280
40% - 50%	1,491	0,003	0,9999	1,581
50% - 60%	1,794	0,001	0,9999	1,897
60% - 70%	2,095	-0,004	0,9999	2,214
70% - 80%	2,396	-0,010	0,9999	2,531
80% - 90%	2,697	-0,008	0,9999	2,846
90% - 100%	2,999	-0,002	0,9999	3,164

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-R1**

Diagram of inductive reactive power absorption



Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-R1**

Connection and starting to generate electrical power		
Test according EN 50438 with standard setting	**Min. voltage for connection to grid:**	197,8 V
	Max. voltage for connection to grid:	250,7 V
	Min. frequency for connection to grid:	49,90 Hz
	Max. frequency for connection to grid:	50,10 Hz
	Observation time (≥60s)	60,0 s

Test		
	Voltage conditions	
a) Start up for voltage range	**<84% Un for twice of observation time**	**>111% Un for twice of observation time**
Connection:	No connection	No connection
Limit:	No connection allowed	
b) In voltage range at start-up	**≥84% Un within twice setting observation time**	**≤111% Un within twice setting observation time**
Reconnection time [s]	64	64
Limit:	Connected after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	
c) In voltage range after voltage failure	**≥84% Un for twice of setting observation time**	**≤111% Un for twice of setting observation time**
Reconnection time [s]	71	69
Limit:	Reconnection after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	
	Frequency conditions	
d) Start up for frequency range	**<47,45 Hz for twice of setting observation time**	**>50,15 Hz for twice of setting observation time**
Connection:	No connection	No connection
Limit	No connection allowed	
e) In frequency range at start-up	**≥47,45 Hz within twice of setting observation time**	**≤51,15 Hz within twice of setting observation time**
Reconnection time [s]	61	63
Limit:	Connected after setting delay time(≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	
f) In frequency range after frequency failure	**≥47,45 Hz for twice of setting observation time**	**≤51,15 Hz for twice of setting observation time**
Reconnection time [s]	63	63
Limit:	Reconnection after setting observation time (≥60s)	
Gradient:	For adjustable micro generators the maximum occurring active power gradient after connection respectively start generating electrical power is less than the configured maximum active power per minute Max gradient: 10%Pn/min.	

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Extract from test report according to EN 50438 **Nr. PV171127N015-R1**

Short-circuit current contribution					
Short-circuit current parameters					
For a directly coupled micro-generator			**For a Inverter micro-generator**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts**	**Amps**
Peak Short Circuit current	I_p	N/A	20ms	28,54	3,094
Initial Value of aperiodic current	A	N/A	100ms	27,40	2,221
Initial symmetrical short-circuit current*	I_k	N/A	250ms	27,17	1,473
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	--	--
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,113	In seconds

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Power Quality. Harmonic current emission				
micro-generator		IMEON 3.6		
Harmonic order n	**Current Magnitude [A] at 100% rated output power**	**% of Fundamental**	**Phase**	**Harmonic current limit EN 61000-3-2, Class A [A]**
1st	13,031	--	Phase 1	-
2nd	0,098	0,751	Phase 1	1,080
3rd	0,230	1,767	Phase 1	2,300
4th	0,028	0,217	Phase 1	0,430
5th	0,067	0,511	Phase 1	1,140
6th	0,020	0,157	Phase 1	0,300
7th	0,064	0,493	Phase 1	0,770
8th	0,016	0,119	Phase 1	0,230
9th	0,041	0,317	Phase 1	0,400
10th	0,011	0,081	Phase 1	0,184
11th	0,036	0,276	Phase 1	0,330
12th	0,010	0,076	Phase 1	0,153
13th	0,032	0,247	Phase 1	0,210
14th	0,008	0,060	Phase 1	0,131
15th	0,033	0,251	Phase 1	0,150
16th	0,006	0,048	Phase 1	0,115
17th	0,032	0,243	Phase 1	0,132
18th	0,006	0,044	Phase 1	0,102
19th	0,025	0,190	Phase 1	0,118
20th	0,006	0,044	Phase 1	0,092
21th	0,023	0,173	Phase 1	0,107
22th	0,005	0,042	Phase 1	0,084
23th	0,019	0,148	Phase 1	0,098
24th	0,005	0,040	Phase 1	0,077
25th	0,020	0,150	Phase 1	0,090
26th	0,005	0,040	Phase 1	0,071
27th	0,015	0,115	Phase 1	0,083
28th	0,006	0,043	Phase 1	0,066
29th	0,016	0,126	Phase 1	0,078
30th	0,007	0,050	Phase 1	0,061
31th	0,014	0,107	Phase 1	0,073
32th	0,007	0,056	Phase 1	0,058
33th	0,014	0,110	Phase 1	0,068
34th	0,007	0,055	Phase 1	0,054
35th	0,014	0,109	Phase 1	0,064
36th	0,006	0,049	Phase 1	0,051
37th	0,015	0,116	Phase 1	0,061
38th	0,006	0,048	Phase 1	0,048
39th	0,016	0,119	Phase 1	0,058
40th	0,007	0,053	Phase 1	0,046

Appendix E Type Verification Test Report	
Extract from test report according to EN 50438	**Nr. PV171127N015-R1**

Voltage fluctuation and Flicker.					
	Maximum permissible flicker and voltage fluctuation as per EN 61000-3-3				
Value	**Pst**	**Plt 2 hours**	**d(t) $_{500ms}$**	**dc**	**dmax**
Limit	1,0	0,65	3,3%	3,3%	4%
Test value	0,22	0,22	0,00%	0,07%	0,45%

DC-Injection.				
Protection limit	Tested at four power levels, limit 0,5% of IAC_{nom} (65,2mA)			
Output power	**~20%**	**~50%**	**75%**	**~100%**
Max. test value (phase L1) [mA]	-63	-49	-63	-28