



**BUREAU
VERITAS**

Certificate of compliance

Applicant: **IMEON ENERGY**
10 Rue Amiral Romain Desfosses
29200 Brest
France

Product: **Inverter**

Model: **IMEON 9.12**

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with EN 50438:2013 for photovoltaic systems with a three-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

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: **PV171127N015-1**

Certificate number: **U18-0549**

Date of issue: **2018-09-20**

Certification body



Holger Schaffer

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



Deutsche
Akkreditierungsstelle
D-ZE-12024-01-00

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

Nr. PV171127N015-1

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 9.12
Maximum rated capacity	9000VA
Rated voltage	230Vac, 50Hz
Firmware version	V4.3.2
Measurement period:	2017-11-27 to 2018-08-31

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.

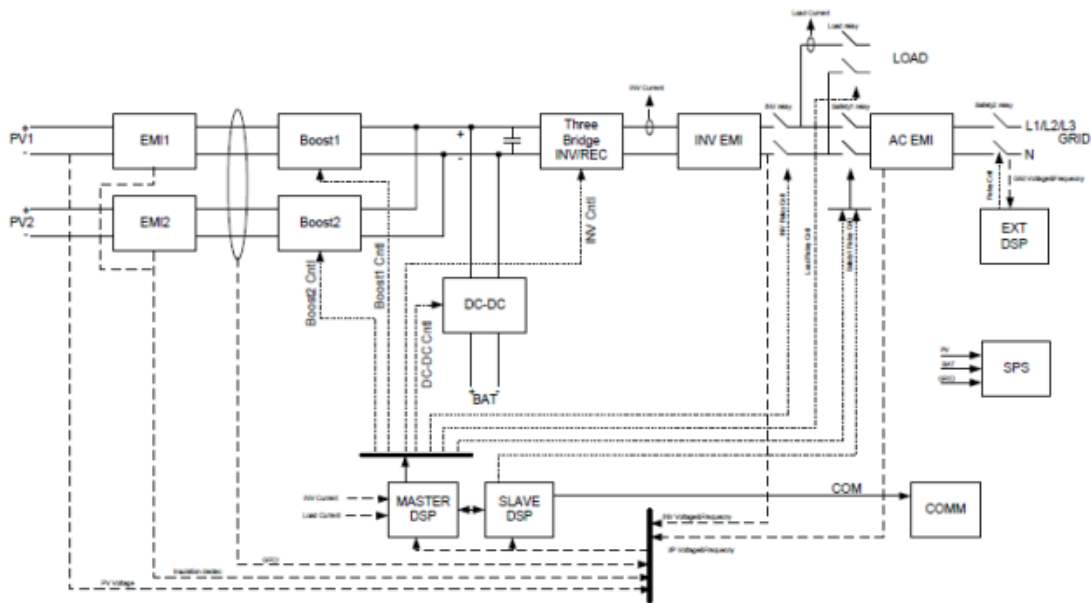


Figure 1 – Schematic structure of the power generation unit

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						
Phase1						
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	3* / 600*	253,0	3* / 600*	253,0	0,081 / 516
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,5	0,154
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,5	1,370
Phase2						
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	3* / 600*	253,0	3* / 600*	253,0	0,089 / 524
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,5	0,169
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,5	1,373
Phase3						
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	3* / 600*	253,0	3* / 600*	253,0	0,089 / 481
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,5	0,172
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,5	1,378

Note.
 Minimum operation time according to default interface protection:
 Over-voltage stage 1 -
 Over-voltage stage 2 0,1s
 Under-voltage 1,2s

* The over-voltage-stage 1 is a 10-min-mean-value according to EN 50160. The disconnection after detection of an overvoltage at the 10-min-mean-value takes place within 200ms.

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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	51,99	0,429
Under-frequency	47,5	0,5	47,5	0,5	47,51	0,394

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					
	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]	123	164	189	122	128	195

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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	197,9	49,50	8,979	0,999
2	254,3	51,50	9,054	0,999

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	49,55	47,55
Active power [kW]:	8,990	8,989	8,987
ΔP/PM [%] per 1 Hz:			-0,039

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% P_n							
Frequency [Hz]:	50,00	50,25	50,70	51,15	50,70	50,25	N/A
PM [kW]:	N/A	4,449	3,632	2,815	3,632	4,449	N/A
PE60 [kW]:	4,500	4,540	3,762	2,902	3,766	4,587	N/A
ΔPE60/PM [%]:	N/A	1,01	1,44	0,97	1,49	1,53	N/A
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n							
Frequency [Hz]:	50,00	50,25	50,70	51,15	50,70	50,25	50,00
PM [kW]:	N/A	8,846	7,222	5,597	7,222	8,846	N/A
PE60 [kW]:	9,027	9,025	7,475	5,808	7,293	8,909	9,025
ΔPE60/PM [%]:	N/A	1,99	2,81	2,34	0,79	0,70	N/A
Limit ΔP/P _{1min} :	+ 10 % of P _M						

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

Controllable reactive power

Inductive (supply reactive power)

Power-BIN	Active power [kW]	Reactive power [kVar]	Power factor (cos φ)	DC power [kW]
0% - 10%	0,724	-0,536	0,8038	0,841
10% - 20%	1,427	-1,042	0,8075	1,568
20% - 30%	2,137	-1,567	0,8065	2,305
30% - 40%	2,909	-2,135	0,8061	3,110
40% - 50%	3,673	-2,698	0,8059	3,911
50% - 60%	4,280	-3,146	0,8057	4,552
60% - 70%	5,027	-3,702	0,8053	5,354
70% - 80%	5,757	-4,260	0,8038	6,126
80% - 90%	6,484	-4,801	0,8036	6,897
90% - 100%	7,214	-5,344	0,8036	7,673

Capacitive (supply reactive power)

Power-BIN	Active power [kW]	Reactive power [kVar]	Power factor (cos φ)	DC power [kW]
0% - 10%	0,724	0,661	0,7385	0,828
10% - 20%	1,448	1,210	0,7672	1,568
20% - 30%	2,203	1,789	0,7763	2,354
30% - 40%	2,848	2,275	0,7813	3,024
40% - 50%	3,604	2,832	0,7863	3,812
50% - 60%	4,244	3,301	0,7894	4,501
60% - 70%	5,015	3,872	0,7915	5,314
70% - 80%	5,683	4,386	0,7916	5,803
80% - 90%	6,568	5,051	0,7927	6,940
90% - 100%	7,268	5,564	0,7940	7,520

Reactive power supply with set point Q=0

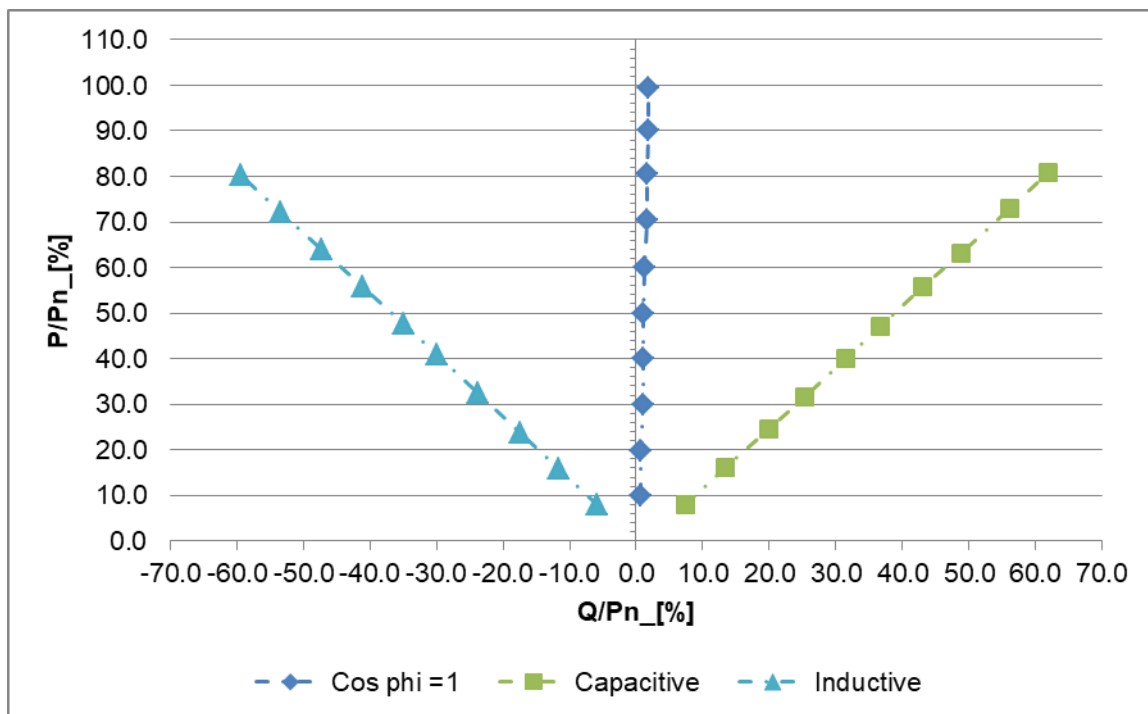
Power-BIN	Active power [kW]	Reactive power [kVar]	Power factor (cos φ)	DC power [kW]
0% - 10%	0,884	0,059	0,9978	1,015
10% - 20%	1,781	0,060	0,9994	1,938
20% - 30%	2,685	0,097	0,9993	2,844
30% - 40%	3,599	0,096	0,9996	3,812
40% - 50%	4,486	0,104	0,9997	4,738
50% - 60%	5,392	0,120	0,9998	5,690
60% - 70%	6,329	0,148	0,9997	6,092
70% - 80%	7,254	0,154	0,9998	7,618
80% - 90%	8,102	0,159	0,9998	8,224
90% - 100%	8,942	0,167	0,9998	9,392

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Diagram of inductive reactive power absorption



Q adjustment				
	Reactive power set point Q [Var]	Measured reactive power Q [Var]	Measured cos φ	Deviation compared to setpoint ΔQ / PN [%]
- Qmin	-3,924	-4,006	0,901	-0,91
0	0	-0,040	0,999	-0,44
+ Qmax	3,924	3,903	0,900	-0,23

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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:	47,55 Hz
	Max. frequency for connection to grid:	50,05 Hz
	Observation time ($\geq 60s$)	60,0 s
Test		
Voltage conditions		
a) Start up for voltage range	<84% U_n for twice of observation time	>111% U_n for twice of observation time
Connection:	No connection	No connection
Limit:	No connection allowed	
b) In voltage range at start-up	$\geq 84\% U_n$ within twice setting observation time	$\leq 111\% U_n$ within twice setting observation time
Reconnection time [s]	69	62
Limit:	Connected after setting observation time ($\geq 60s$)	
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% P_n /min..	
c) In voltage range after voltage failure	$\geq 84\% U_n$ for twice of setting observation time	$\leq 111\% U_n$ for twice of setting observation time
Reconnection time [s]	61	69
Limit:	Reconnection after setting observation time ($\geq 60s$)	
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% P_n /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	$\geq 47,45$ Hz within twice of setting observation time	$\leq 50,15$ Hz within twice of setting observation time
Reconnection time [s]	65	69
Limit:	Connected after setting delay time ($\geq 60s$)	
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% P_n /min.	
f) In frequency range after frequency failure	$\geq 47,45$ Hz for twice of setting observation time	$\leq 50,10$ Hz for twice of setting observation time
Reconnection time [s]	67	64
Limit:	Reconnection after setting observation time ($\geq 60s$)	
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% P_n /min.	

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Short-circuit current contribution					
Short-circuit current parameters					
Phase 1					
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	27,7	14,962
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0,098	In seconds
Phase 2					
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	36,4	15,835
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0,098	In seconds
Phase 3					
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	36,2	15,515
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0,098	In seconds

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Power Quality. Harmonic current emission				
micro-generator		IMEON 9.12		
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	12,803	-	Phase 1	-
2nd	0,068	-	Phase 1	1,080
3rd	0,151	-	Phase 1	2,300
4th	0,017	-	Phase 1	0,430
5th	0,131	-	Phase 1	1,140
6th	0,011	-	Phase 1	0,300
7th	0,099	-	Phase 1	0,770
8th	0,010	-	Phase 1	0,230
9th	0,109	-	Phase 1	0,400
10th	0,011	-	Phase 1	0,184
11th	0,119	-	Phase 1	0,330
12th	0,011	-	Phase 1	0,153
13th	0,120	-	Phase 1	0,210
14th	0,012	-	Phase 1	0,131
15th	0,145	-	Phase 1	0,150
16th	0,014	-	Phase 1	0,115
17th	0,122	-	Phase 1	0,132
18th	0,015	-	Phase 1	0,102
19th	0,114	-	Phase 1	0,118
20th	0,014	-	Phase 1	0,092
21th	0,097	-	Phase 1	0,107
22th	0,013	-	Phase 1	0,084
23th	0,082	-	Phase 1	0,098
24th	0,012	-	Phase 1	0,077
25th	0,049	-	Phase 1	0,090
26th	0,011	-	Phase 1	0,071
27th	0,044	-	Phase 1	0,083
28th	0,009	-	Phase 1	0,066
29th	0,018	-	Phase 1	0,078
30th	0,008	-	Phase 1	0,061
31th	0,022	-	Phase 1	0,073
32th	0,007	-	Phase 1	0,058
33th	0,024	-	Phase 1	0,068
34th	0,006	-	Phase 1	0,054
35th	0,008	-	Phase 1	0,064
36th	0,006	-	Phase 1	0,051
37th	0,013	-	Phase 1	0,061
38th	0,005	-	Phase 1	0,048
39th	0,013	-	Phase 1	0,058
40th	0,005	-	Phase 1	0,046

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Power Quality. Harmonic current emission				
micro-generator		IMEON 9.12		
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	13,046	-	Phase 2	-
2nd	0,066	-	Phase 2	1,080
3rd	0,171	-	Phase 2	2,300
4th	0,019	-	Phase 2	0,430
5th	0,144	-	Phase 2	1,140
6th	0,013	-	Phase 2	0,300
7th	0,106	-	Phase 2	0,770
8th	0,012	-	Phase 2	0,230
9th	0,119	-	Phase 2	0,400
10th	0,014	-	Phase 2	0,184
11th	0,127	-	Phase 2	0,330
12th	0,014	-	Phase 2	0,153
13th	0,125	-	Phase 2	0,210
14th	0,015	-	Phase 2	0,131
15th	0,146	-	Phase 2	0,150
16th	0,017	-	Phase 2	0,115
17th	0,125	-	Phase 2	0,132
18th	0,020	-	Phase 2	0,102
19th	0,110	-	Phase 2	0,118
20th	0,019	-	Phase 2	0,092
21th	0,098	-	Phase 2	0,107
22th	0,016	-	Phase 2	0,084
23th	0,082	-	Phase 2	0,098
24th	0,015	-	Phase 2	0,077
25th	0,043	-	Phase 2	0,090
26th	0,013	-	Phase 2	0,071
27th	0,053	-	Phase 2	0,083
28th	0,010	-	Phase 2	0,066
29th	0,020	-	Phase 2	0,078
30th	0,009	-	Phase 2	0,061
31th	0,025	-	Phase 2	0,073
32th	0,008	-	Phase 2	0,058
33th	0,029	-	Phase 2	0,068
34th	0,007	-	Phase 2	0,054
35th	0,010	-	Phase 2	0,064
36th	0,007	-	Phase 2	0,051
37th	0,016	-	Phase 2	0,061
38th	0,006	-	Phase 2	0,048
39th	0,012	-	Phase 2	0,058
40th	0,005	-	Phase 2	0,046

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Power Quality. Harmonic current emission				
micro-generator		IMEON 9.12		
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	12,657	-	Phase 3	-
2nd	0,029	-	Phase 3	1,080
3rd	0,235	-	Phase 3	2,300
4th	0,016	-	Phase 3	0,430
5th	0,286	-	Phase 3	1,140
6th	0,011	-	Phase 3	0,300
7th	0,145	-	Phase 3	0,770
8th	0,010	-	Phase 3	0,230
9th	0,058	-	Phase 3	0,400
10th	0,012	-	Phase 3	0,184
11th	0,114	-	Phase 3	0,330
12th	0,011	-	Phase 3	0,153
13th	0,167	-	Phase 3	0,210
14th	0,011	-	Phase 3	0,131
15th	0,142	-	Phase 3	0,150
16th	0,014	-	Phase 3	0,115
17th	0,116	-	Phase 3	0,132
18th	0,016	-	Phase 3	0,102
19th	0,113	-	Phase 3	0,118
20th	0,015	-	Phase 3	0,092
21th	0,106	-	Phase 3	0,107
22th	0,014	-	Phase 3	0,084
23th	0,090	-	Phase 3	0,098
24th	0,014	-	Phase 3	0,077
25th	0,051	-	Phase 3	0,090
26th	0,012	-	Phase 3	0,071
27th	0,034	-	Phase 3	0,083
28th	0,011	-	Phase 3	0,066
29th	0,019	-	Phase 3	0,078
30th	0,009	-	Phase 3	0,061
31th	0,038	-	Phase 3	0,073
32th	0,008	-	Phase 3	0,058
33th	0,036	-	Phase 3	0,068
34th	0,008	-	Phase 3	0,054
35th	0,014	-	Phase 3	0,064
36th	0,007	-	Phase 3	0,051
37th	0,014	-	Phase 3	0,061
38th	0,006	-	Phase 3	0,048
39th	0,019	-	Phase 3	0,058
40th	0,005	-	Phase 3	0,046

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Voltage fluctuation and Flicker.					
Phase 1	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	0,11	0,11	0,00	0,02	0,16
Phase 2	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	0,10	0,10	0,00	0,00	0,00
Phase 3	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	0,07	0,07	0,00	0,00	0,00

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]	5,4	13,8	17,3	25,6
Max. test value (phase L2) [mA]	-24,9	-22,7	-19,4	-23,9
Max. test value (phase L3) [mA]	8,0	18,9	22,8	25,2