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, 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:	**PV171127N015-1**
Certificate number:	**U18-0548**
Date of issue:	**2018-09-20**

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. PV171127N015-1**

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.

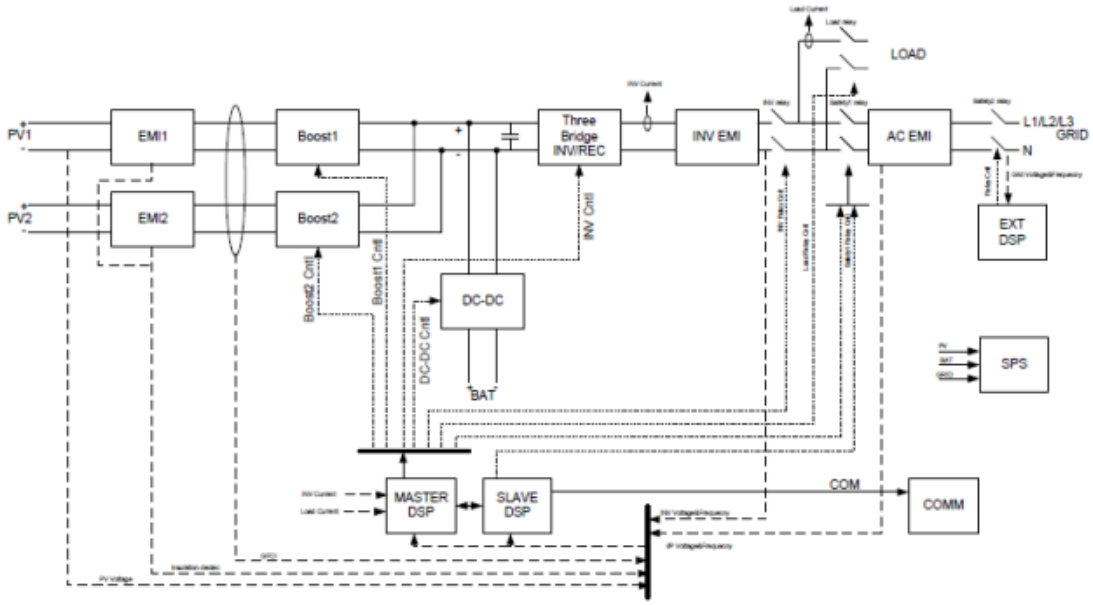


Figure 1 – Schematic structure of the power generation unit

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.

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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	0,5	253,0	0,5	253,0	0,081
Under-voltage stage 1	207,0	0,5	207,0	0,5	207,0	0,183
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	0,5	253,0	0,5	253,0	0,089
Under-voltage stage 1	207,0	0,5	207,0	0,5	207,0	0,140
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	0,5	253,0	0,5	253,0	0,089
Under-voltage stage 1	207,0	0,5	207,0	0,5	207,0	0,157

Note.
Minimum operation time according to default interface protection:
Over-voltage stage 1 0,5
Under-voltage 0,5

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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	47,01	0,071

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]	123	164	189	122	128	195

Appendix E Type Verification Test Report	
Extract from test report according to EN 50438	Nr. PV171127N015-1

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% Pn							
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% Pn							
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/P1min:	+ 10 % of P_M						

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

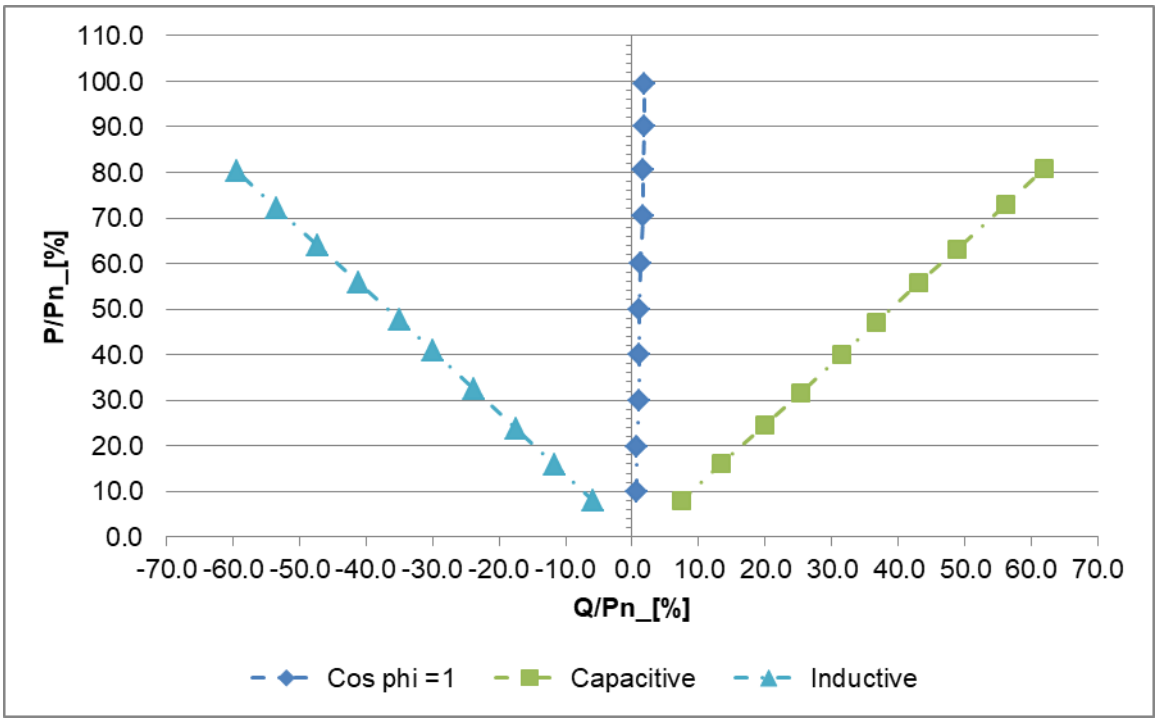
Reactive power			
Uncontrollable reactive power			
Test Voltage / Output power	**211,6V**	**230V**	**248,4V**
25% PN	0,999c	0,999c	0,999c
50% PN	0,999c	0,999c	0,999c
75% PN	0,999c	0,999c	0,999c
100% PN	0,999c	0,999c	0,999c
Limit	**>0,95**	**>0,95**	**>0,95**

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

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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 (≥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]	69	62
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]	61	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**	**≤50,15 Hz within twice of setting observation time**
Reconnection time [s]	65	69
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**	**≤50,10 Hz for twice of setting observation time**
Reconnection time [s]	67	64
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.	

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV171127N015-1**

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