



**BUREAU
VERITAS**

Certificate of compliance

Applicant: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal
Germany

Product: Grid-tied photovoltaic (PV) inverter

Model: STP 5000TL-20
STP 6000TL-20
STP 7000TL-20
STP 8000TL-20
STP 9000TL-20
STP 10000TL-20
STP 12000TL-20

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

The generator STP 12000TL-20 is rated >16A per phase. However all requirements of the EN 50438:2013 are fulfilled.

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: 12TH0259_EN50438-2013_0
Certificate number: U17-0491
Date of issue: 2017-09-07



Certification body

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. 12TH0259_EN50438-2013_0

Type Approval and declaration of compliance with the requirements of EN 50438.

Manufacturer / applicant:	SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Germany						
Micro-generator Type	Grid-tied photovoltaic inverter						
Rated values	STP 5000TL-20	STP 6000TL-20	STP 7000TL-20	STP 8000TL-20	STP 9000TL-20	STP 10000TL-20	STP 12000TL-20
Maximum rated capacity	5,0 kW	6,0 kW	7,0 kW	8,0 kW	9,0 kW	10,0 kW	12,0 kW
Rated voltage	400V / 230V L1, L2, L3, N, PE						
From Firmware version	2.55						
Measurement period:	2016-06-02 to 2016-07-14						
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.							
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	600*	253,0	600*	253,00	505*
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,81	0,176
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,33	1,476
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	600*	253,0	600*	253,00	505*
Over-voltage stage 2	264,5	0,2	264,5	0,2	265,24	0,176
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,37	1,476
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	600*	253,0	600*	253,00	505*
Over-voltage stage 2	264,5	0,2	264,5	0,2	265,23	0,176
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,30	1,476

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	52,02	0,484
Under-frequency	47,5	0,5	47,5	0,5	47,50	0,483

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]	60	80	58	N/A	56	242
Trip time. Phase 2 fuse removed [ms]	60	80	58	N/A	56	242
Trip time. Phase 3 fuse removed [ms]	60	80	58	N/A	56	242

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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	195,5	47,50	4268	1,0
2	253,0	51,50	5012	1,0

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 [W]:	10774	10773	10793
ΔP/PM [%] per 1 Hz:			0,16

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 [W]:	10783	10693	9884	9077	9884	10693	N/A
PE60 [W]:	10783	10689	9867	9047	9867	10688	N/A
ΔPE60/PM [%]:	0,00	0,03	0,08	0,03	0,02	0,05	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 [W]:	6005	5954	5504	5054	5504	5954	N/A
PE60 [W]:	6005	5961	5507	5047	5506	5968	N/A
ΔPE60/PM [%]:	0,00	0,11	0,05	0,13	0,04	0,23	N/A
Limit ΔP/P1min:	+ 10 % of P _M						



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Reactive power			
Uncontrollable reactive power STP 9000TL-20			
Test Voltage	210V	230V	250V
Output power			
20% PN	0,997	0,997	0,995
50% PN	0,999	0,999	0,999
60% PN	0,999	0,999	0,999
80% PN	0,999	0,999	0,999
100% PN	0,999	0,999	0,999
Limit	>0,95	>0,95	>0,95
Uncontrollable reactive power STP 10000TL-20			
Test Voltage	210V	230V	250V
Output power			
20% PN	0,996	0,994	0,981
50% PN	0,999	0,998	0,996
60% PN	0,999	0,999	0,999
80% PN	0,999	0,999	0,999
100% PN	0,999	0,999	0,999
Limit	>0,95	>0,95	>0,95
Uncontrollable reactive power STP12000TL-20			
Test Voltage	210V	230V	250V
Output power			
20% PN	0,992	0,990	0,975
50% PN	0,999	0,996	0,996
60% PN	0,999	0,998	0,997
80% PN	0,999	0,999	0,999
100% PN	0,999	0,999	0,999
Limit	>0,95	>0,95	>0,95

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Controllable reactive power

Fix Power Factor

Power-BIN	Power factor $\cos \phi_u$ [1]	Power factor $\cos \phi_o$ [1]	Power factor $\cos \phi_o$ [1]
0% - 10%	-0,822	0,996	0,882
10% - 20%	-0,842	1,000	0,858
20% - 30%	-0,845	1,000	0,855
30% - 40%	-0,847	1,000	0,853
40% - 50%	-0,848	1,000	0,852
50% - 60%	-0,849	1,000	0,852
60% - 70%	-0,850	1,000	0,851
70% - 80%	-0,850	1,000	0,851
80% - 90%	-0,850	1,000	0,850
90% - 100%	-0,850	1,000	0,850

Diagram of inductive reactive power absorption

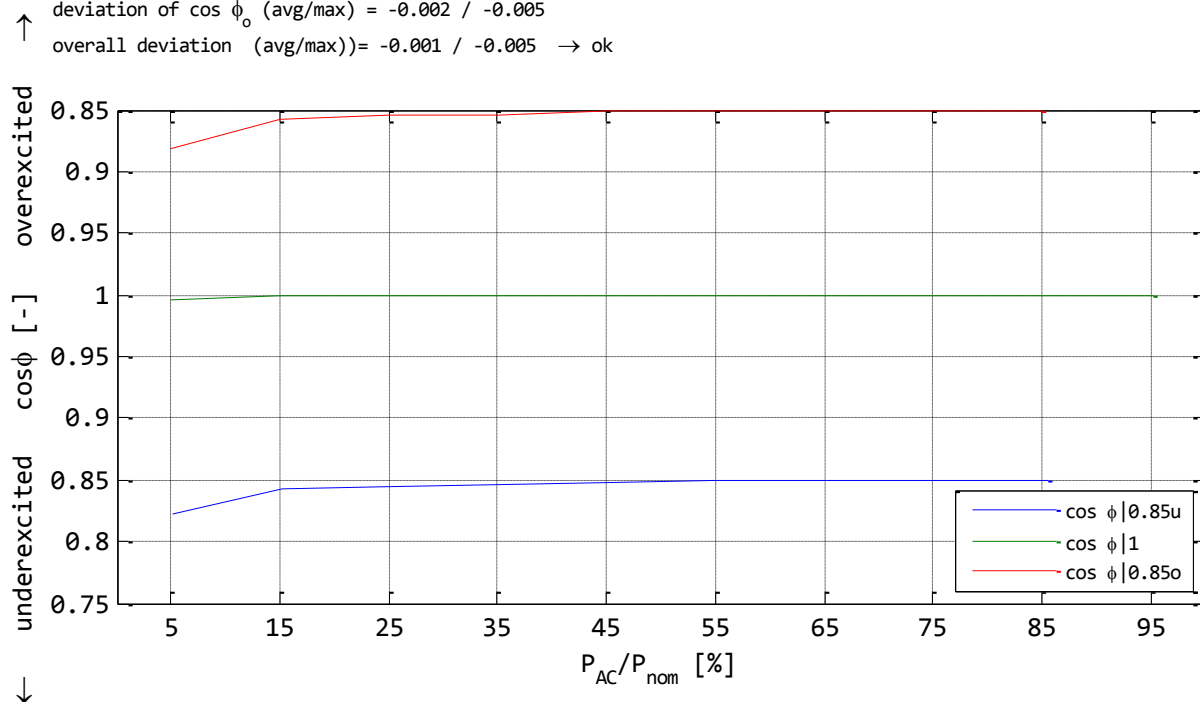
Verification of reactive power (power factor, permitted deviation(max) = 0.01 @ $P/P_{nom} \geq 25\%$)

deviation of $\cos \phi_u$ (avg/max) = -0.001 / -0.005

deviation of $\cos \phi_o$ (avg/max) = -0.000 / -0.000

deviation of $\cos \phi_o$ (avg/max) = -0.002 / -0.005

overall deviation (avg/max) = -0.001 / -0.005 → ok



Appendix E Type Verification Test Report

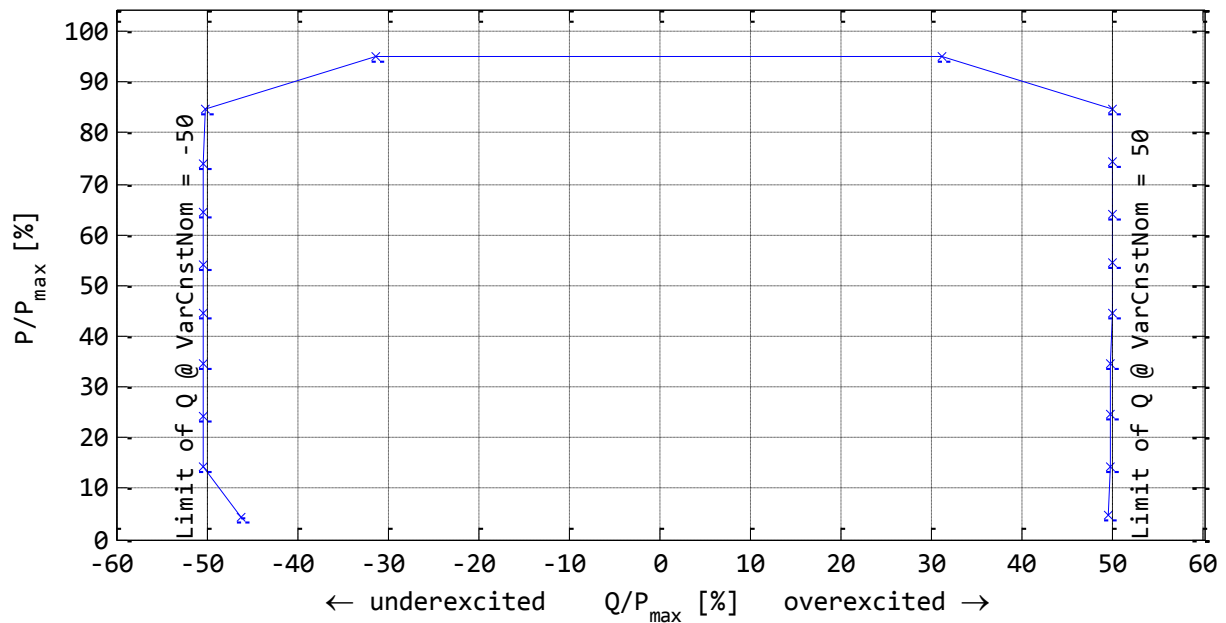
Extract from test report according to EN 50438

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Fix Reactive				
Power-BIN	P / S _n [%]	Q _u / S _n [%]	P / S _n [%]	Q _o / S _n [%]
0% - 10%	4,37	-46,12	4,6	49,52
10% - 20%	14,12	-50,48	14,47	49,69
20% - 30%	24,37	-50,45	24,52	49,72
30% - 40%	34,43	-50,43	34,62	49,76
40% - 50%	44,38	-50,39	44,57	49,80
50% - 60%	54,17	-50,37	54,31	49,83
60% - 70%	64,47	-50,33	64,19	49,86
70% - 80%	73,88	-50,30	74,38	49,89
80% - 90%	84,59	-50,24	84,58	49,92
90% - 100%	94,94	-31,39	94,91	31,11

Diagram of inductive reactive power

Verification of reactive power (reactive power, permitted deviation(max) = 2.00% @ P/P_{max} >= 25%)
 deviation of Q_u (avg/max) = -0.16 % / -0.28 %
 deviation of Q_o (avg/max) = -0.34 % / -0.45 %
 overall deviation (avg/max) = -0.25 % / -0.45 % → ok



Q adjustment

	Reactive power set point Q [%]	Measured reactive power Q [%]	Deviation compared to setpoint ΔQ / PN [%]	Measured active power P [%]
0	0	-0,551	-0,551	51,121
- Qmin	-50	50,599	-0,474	50,490
0	0	-0,545	-0,547	51,130
+ Qmax	+50	49,526	-0,599	50,557
0	0	-0,567	-0,545	51,146

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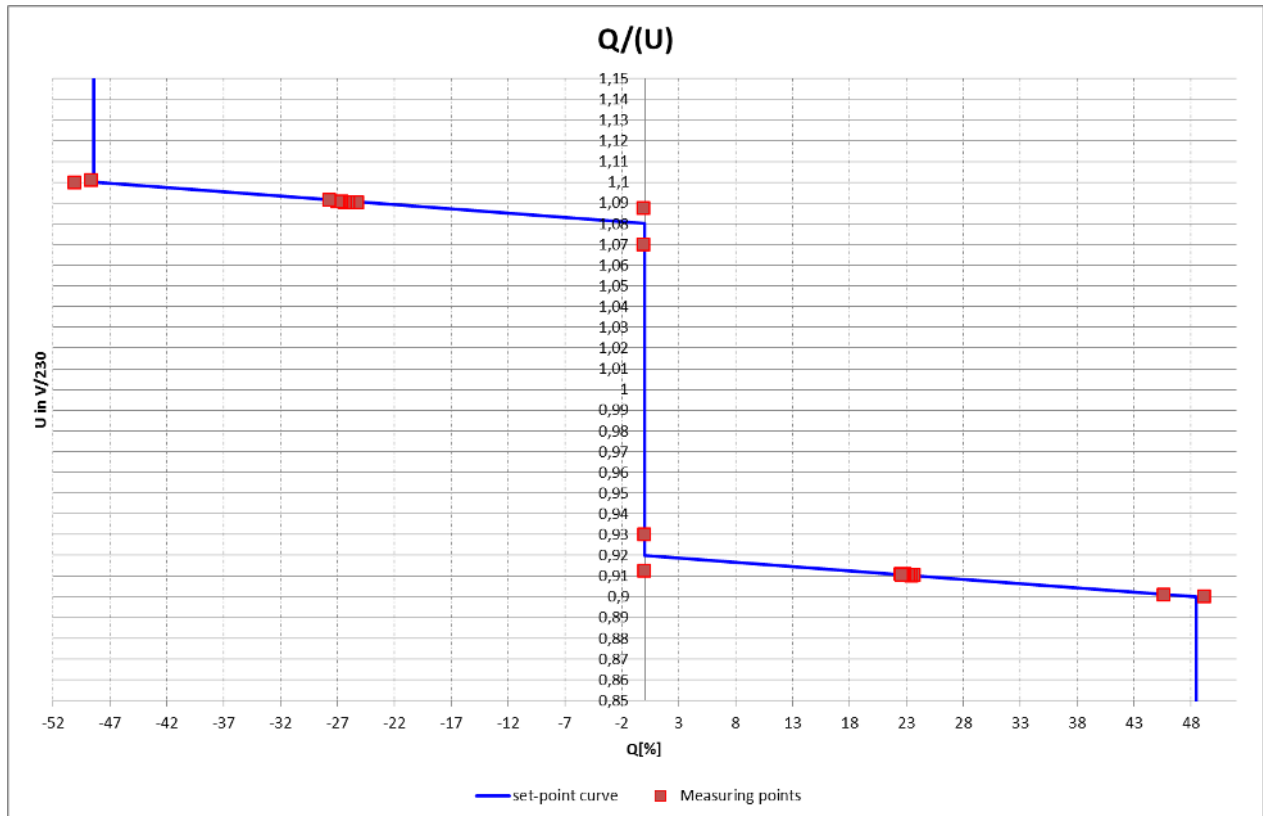
Qmin reactive power in accordance to standard characteristic curve $Q = f(V)$						
P/Pn	Vac [V] Set point	P [W]	Vac [V] measured	Q [Var] measured	Q [Var] expected	ΔQ [%]
< 20%	1,07Vn	1108,47	246,14	-14,80	$\approx 0 (< \pm 2.5\% P_n)$	-0,14
< 20%	1,09Vn	1097,74	250,13	-15,15	$\approx 0 (< \pm 2.5\% P_n)$	-0,14
< 20%-30%	1,09Vn	3189,63	250,75	-2725,80	-0,5 Qmin	0,45
40%	1,09Vn	4201,93	250,77	-2812,92	-0,5 Qmin	1,12
50%	1,09Vn	5408,69	250,81	-2844,98	-0,5 Qmin	1,02
60%	1,09Vn	6449,52	250,84	-2878,60	-0,5 Qmin	1,01
70%	1,09Vn	7489,58	250,84	-2884,23	-0,5 Qmin	1,06
80%	1,09Vn	8527,46	250,87	-2906,97	-0,5 Qmin	0,88
90%	1,09Vn	9554,07	250,88	-2914,70	-0,5 Qmin	0,83
100%	1,09Vn	10576,73	251,05	-2993,00	-0,5 Qmin	-0,17
100%	1,1Vn	10553,54	253,21	-5258,88	-Qmin	-0,26
100%-10%	1,1Vn	1030,44	253,01	-5415,03	-Qmin	-1,71
10% \rightarrow $\leq 5\%$	1,1Vn	503,63	250,43	-143,80	$\approx 0 (< \pm 2.5\% P_n)$	-1,33
Qmax reactive power in accordance to standard characteristic curve $Q = f(V)$						
P/Pn	Vac [V] Set point	P [W]	Vac [V] measured	Q [Var] measured	Q [Var] expected	ΔQ [%]
< 20%	0,93Vn	1100,88	213,93	-9,10	$\approx 0 (< \pm 2.5\% P_n)$	-0,08
< 20%	0,91Vn	1094,61	209,90	-8,43	$\approx 0 (< \pm 2.5\% P_n)$	-0,08
< 20%-30%	0,91Vn	3205,19	209,37	2526,20	-0,5 Qmin	-0,05
40%	0,91Vn	4211,08	209,40	2553,34	-0,5 Qmin	0,52
50%	0,91Vn	5416,11	209,45	2519,76	-0,5 Qmin	0,65
60%	0,91Vn	6454,89	209,47	2497,58	-0,5 Qmin	0,68
70%	0,91Vn	7484,43	209,51	2465,60	-0,5 Qmin	0,82
80%	0,91Vn	8511,56	209,51	2449,24	-0,5 Qmin	0,66
90%	0,91Vn	9543,43	209,53	2424,63	-0,5 Qmin	0,63
100%	0,91Vn	10560,55	209,44	2438,93	-0,5 Qmin	-0,18
100%	0,90Vn	9977,69	207,28	5220,26	-Qmin	-0,23
100%-10%	0,90Vn	1014,38	207,04	5306,27	-Qmin	-0,70
10% \rightarrow $\leq 5\%$	0,90Vn	445,42	207,00	126,78	$\approx 0 (< \pm 2.5\% P_n)$	1,17

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Graph



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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
	Max. voltage for connection to grid:	250,7
	Min. frequency for connection to grid:	47,55
	Max. frequency for connection to grid:	50,05
	Observation time ($\geq 60s$)	60s
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 reconnection	No reconnection
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]	74,83	75,07
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. For recorded gradient see diagram below.	
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]	69,13	68,05
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. For recorded gradient see diagram below.	
	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 reconnection	No reconnection
Limit:	No connection allowed	
e) In frequency range at start-up	$\geq 47,45$ Hz within twice of setting observation time	$\leq 51,15$ Hz within twice of setting observation time
Reconnection time [s]	78,33	75,01
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. For recorded gradient see diagram below.	

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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]	71,71	68,14
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. For recorded gradient see diagram below.	

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	230,53	20,33
Initial Value of aperiodic current	A	N/A	100ms	11,51	0,03
Initial symmetrical short-circuit current*	I_k	N/A	250ms	11,47	0,03
Decaying (aperiodic) component of short circuit current*	i_{dc}	N/A	500ms	11,46	0,03
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	1,45	In seconds

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Power Quality. Harmonic current emission

micro-generator

STP 12000TL-20

Testconditions: Sequence "normative" according to G59-3:2013-09 acc. to DIN EN 61000-3-12:2012-06 Table 3*

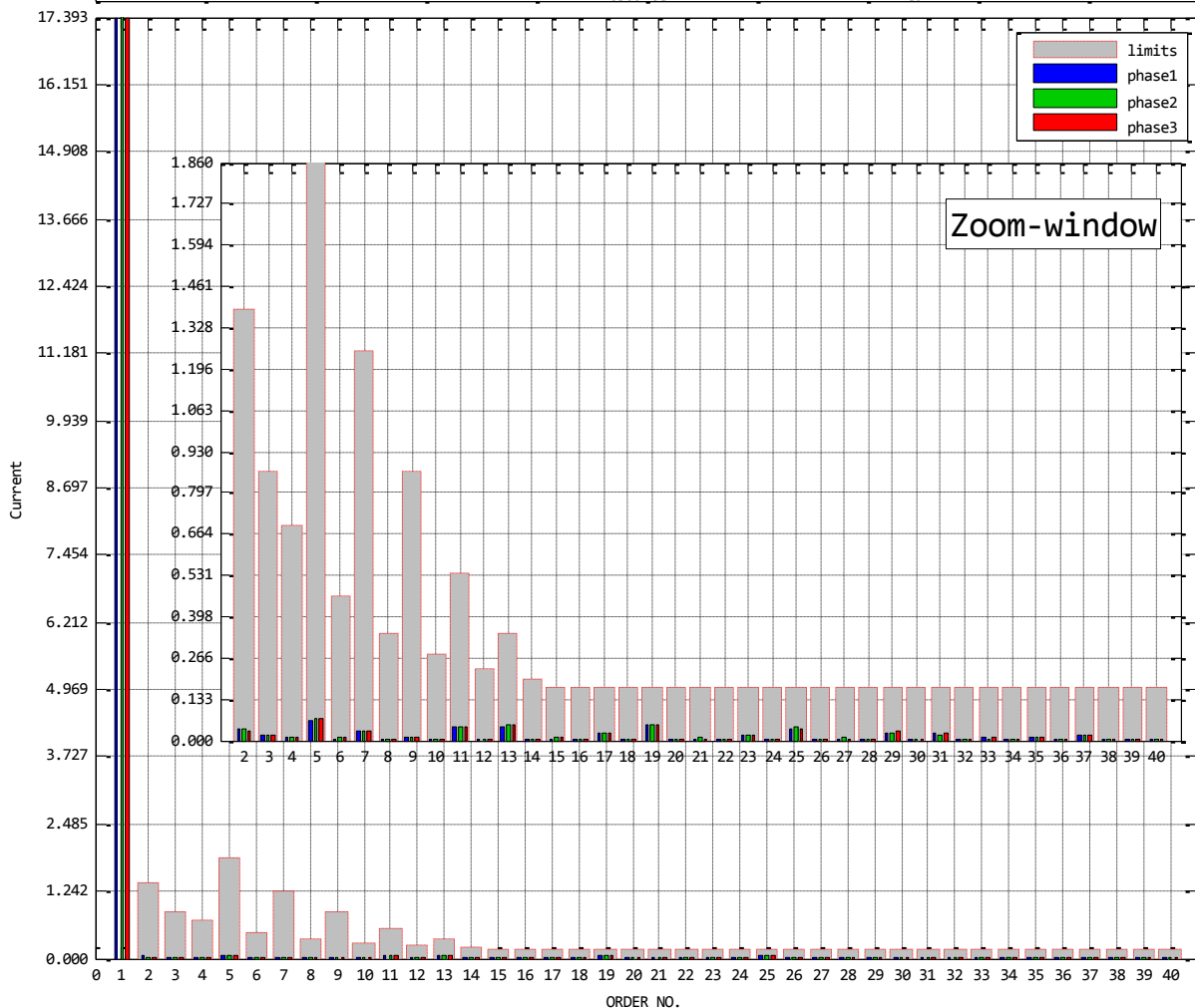
Device under test	: STP12000TL-20	rated AC current	: 17.39 A
AC voltage	: 230 V	PV voltage	: 580 V
frequency	: 50 Hz	power stage	: 100 %
test duration	: 180 s	power factor	: 1u
country set	: GB593	I _{ref}	: Inom

*Limits at minimal short circuit ratio Rsce = 33 → Ssc = 396000 VA

Line Impedance Simulation: phase: --- neutral: ---

Measurements:

phase 1:	power = 4007.5 W	THDu _{AcSource}	= 0.038 %	PF _{mean}	= 1
phase 2:	power = 4001 W	THDu _{AcSource}	= 0.041 %	PF _{mean}	= 1
phase 3:	power = 3997.26 W	THDu _{AcSource}	= 0.037 %	PF _{mean}	= 1



	THDu ₄₀ [%]	THDi ₄₀ [%]	PWHD ₁₄₋₄₀ [%]	THC ₄₀ / I _{ref} [%]	PWHC ₁₄₋₄₀ / I _{ref} [%]	TDDi ₄₀ [%]
limits	---	---	---	13.000	22.000	---
phase 1	0.079	0.758	2.268	0.758	2.268	0.758
phase 2	0.078	0.780	2.228	0.780	2.228	0.780
phase 3	0.075	0.771	2.270	0.771	2.270	0.771



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Testconditions:

dut = STP12000TL-20; phase = L1; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;
 standard = G59-3; PV voltage = 580 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	norm Avg	Limits [A]*	Result
DC	0.0320	165	---	---	0.0120	0.0110	---	ok
1	17.3900	554	---	---	17.3790	15.9890	---	ok
2	0.0450	839	2.0860	---	0.0390	0.0360	1.3900	ok
3	0.0190	625	1.3030	---	0.0140	0.0130	0.8690	ok
4	0.0160	169	1.0430	---	0.0130	0.0120	0.6950	ok
5	0.0710	772	2.7890	---	0.0620	0.0570	1.8600	ok
6	0.0100	852	0.6950	---	0.0060	0.0060	0.4630	ok
7	0.0330	677	1.8770	---	0.0290	0.0260	1.2510	ok
8	0.0080	725	0.5210	---	0.0060	0.0050	0.3480	ok
9	0.0100	240	1.3030	---	0.0080	0.0070	0.8690	ok
10	0.0070	852	0.4170	---	0.0060	0.0050	0.2780	ok
11	0.0470	551	0.8080	---	0.0450	0.0410	0.5390	ok
12	0.0050	524	0.3480	---	0.0040	0.0030	0.2320	ok
13	0.0480	82	0.5210	---	0.0460	0.0420	0.3480	ok
14	0.0050	850	0.2980	---	0.0040	0.0030	0.1990	ok
15	0.0080	165	0.2610	---	0.0070	0.0060	0.1740	ok
16	0.0040	352	0.2610	---	0.0030	0.0030	0.1740	ok
17	0.0250	671	0.2610	---	0.0240	0.0220	0.1740	ok
18	0.0040	411	0.2610	---	0.0030	0.0030	0.1740	ok
19	0.0500	736	0.2610	---	0.0480	0.0440	0.1740	ok
20	0.0040	172	0.2610	---	0.0030	0.0030	0.1740	ok
21	0.0070	523	0.2610	---	0.0060	0.0050	0.1740	ok
22	0.0040	760	0.2610	---	0.0030	0.0030	0.1740	ok
23	0.0190	686	0.2610	---	0.0180	0.0160	0.1740	ok
24	0.0040	187	0.2610	---	0.0030	0.0030	0.1740	ok
25	0.0410	148	0.2610	---	0.0400	0.0370	0.1740	ok
26	0.0040	771	0.2610	---	0.0030	0.0030	0.1740	ok
27	0.0060	281	0.2610	---	0.0050	0.0050	0.1740	ok
28	0.0040	853	0.2610	---	0.0030	0.0030	0.1740	ok
29	0.0280	789	0.2610	---	0.0260	0.0240	0.1740	ok
30	0.0040	662	0.2610	---	0.0030	0.0030	0.1740	ok
31	0.0230	888	0.2610	---	0.0220	0.0200	0.1740	ok
32	0.0040	340	0.2610	---	0.0030	0.0030	0.1740	ok
33	0.0080	23	0.2610	---	0.0070	0.0060	0.1740	ok
34	0.0020	101	0.2610	---	0.0020	0.0020	0.1740	ok
35	0.0080	734	0.2610	---	0.0070	0.0070	0.1740	ok
36	0.0020	212	0.2610	---	0.0020	0.0020	0.1740	ok
37	0.0190	32	0.2610	---	0.0180	0.0170	0.1740	ok
38	0.0020	848	0.2610	---	0.0020	0.0010	0.1740	ok
39	0.0030	851	0.2610	---	0.0020	0.0020	0.1740	ok
40	0.0020	829	0.2610	---	0.0010	0.0010	0.1740	ok

* limits at minimum Rsce = 33



Appendix E Type Verification Test Report

Extract from test report according to EN 50438

Nr. 12TH0259_EN50438-2013_0

Testconditions:

dut = STP12000TL-20; phase = L2; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;
 standard = G59-3; PV voltage = 580 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	norm Avg	Limits [A]*	Result
DC	0.0320	165	---	---	0.0120	0.0110	---	ok
1	17.4010	550	---	---	17.3930	16.0020	---	ok
2	0.0410	661	2.0870	---	0.0370	0.0340	1.3910	ok
3	0.0200	851	1.3050	---	0.0150	0.0130	0.8700	ok
4	0.0160	757	1.0440	---	0.0130	0.0120	0.6960	ok
5	0.0790	683	2.7920	---	0.0700	0.0640	1.8610	ok
6	0.0110	170	0.6960	---	0.0070	0.0060	0.4640	ok
7	0.0330	11	1.8790	---	0.0290	0.0260	1.2520	ok
8	0.0070	477	0.5220	---	0.0050	0.0050	0.3480	ok
9	0.0120	350	1.3050	---	0.0100	0.0090	0.8700	ok
10	0.0080	893	0.4170	---	0.0060	0.0060	0.2780	ok
11	0.0470	579	0.8090	---	0.0450	0.0410	0.5390	ok
12	0.0060	576	0.3480	---	0.0040	0.0040	0.2320	ok
13	0.0500	528	0.5220	---	0.0480	0.0440	0.3480	ok
14	0.0050	670	0.2980	---	0.0040	0.0040	0.1990	ok
15	0.0090	170	0.2610	---	0.0080	0.0070	0.1740	ok
16	0.0050	350	0.2610	---	0.0040	0.0030	0.1740	ok
17	0.0250	870	0.2610	---	0.0230	0.0210	0.1740	ok
18	0.0050	350	0.2610	---	0.0040	0.0040	0.1740	ok
19	0.0510	169	0.2610	---	0.0490	0.0450	0.1740	ok
20	0.0040	10	0.2610	---	0.0030	0.0030	0.1740	ok
21	0.0080	279	0.2610	---	0.0070	0.0060	0.1740	ok
22	0.0040	343	0.2610	---	0.0030	0.0030	0.1740	ok
23	0.0160	473	0.2610	---	0.0150	0.0140	0.1740	ok
24	0.0040	350	0.2610	---	0.0030	0.0030	0.1740	ok
25	0.0430	55	0.2610	---	0.0410	0.0380	0.1740	ok
26	0.0050	802	0.2610	---	0.0040	0.0030	0.1740	ok
27	0.0090	279	0.2610	---	0.0070	0.0070	0.1740	ok
28	0.0050	156	0.2610	---	0.0040	0.0030	0.1740	ok
29	0.0260	811	0.2610	---	0.0240	0.0230	0.1740	ok
30	0.0050	899	0.2610	---	0.0040	0.0040	0.1740	ok
31	0.0190	300	0.2610	---	0.0170	0.0160	0.1740	ok
32	0.0040	340	0.2610	---	0.0030	0.0030	0.1740	ok
33	0.0070	817	0.2610	---	0.0060	0.0060	0.1740	ok
34	0.0030	340	0.2610	---	0.0020	0.0020	0.1740	ok
35	0.0090	264	0.2610	---	0.0080	0.0080	0.1740	ok
36	0.0020	722	0.2610	---	0.0020	0.0020	0.1740	ok
37	0.0180	308	0.2610	---	0.0170	0.0150	0.1740	ok
38	0.0020	347	0.2610	---	0.0020	0.0020	0.1740	ok
39	0.0030	31	0.2610	---	0.0030	0.0030	0.1740	ok
40	0.0020	566	0.2610	---	0.0010	0.0010	0.1740	ok

* limits at minimum Rsce = 33



Appendix E Type Verification Test Report

Extract from test report according to EN 50438

Nr. 12TH0259_EN50438-2013_0

Testconditions:

dut = STP12000TL-20; phase = L3; voltage = 230.00 V; frequency = 50 Hz; test duration = 180 s;
 standard = G59-3; PV voltage = 580 V; power factor = 1u; power stage = 100 %

Order	Maximum	Window	Limits*1.5 [A]	Result	Average	norm Avg	Limits [A]*	Result
DC	0.0320	165	---	---	0.0120	0.0110	---	ok
1	17.3890	409	---	---	17.3810	15.9900	---	ok
2	0.0370	102	2.0860	---	0.0310	0.0290	1.3900	ok
3	0.0180	349	1.3040	---	0.0140	0.0130	0.8690	ok
4	0.0150	669	1.0430	---	0.0100	0.0090	0.6950	ok
5	0.0750	595	2.7900	---	0.0680	0.0620	1.8600	ok
6	0.0100	671	0.6950	---	0.0070	0.0060	0.4630	ok
7	0.0350	11	1.8770	---	0.0300	0.0280	1.2510	ok
8	0.0060	349	0.5210	---	0.0050	0.0050	0.3480	ok
9	0.0090	129	1.3040	---	0.0080	0.0070	0.8690	ok
10	0.0070	732	0.4170	---	0.0050	0.0050	0.2780	ok
11	0.0490	784	0.8080	---	0.0460	0.0430	0.5390	ok
12	0.0050	847	0.3480	---	0.0040	0.0040	0.2320	ok
13	0.0490	52	0.5210	---	0.0470	0.0440	0.3480	ok
14	0.0050	617	0.2980	---	0.0040	0.0030	0.1990	ok
15	0.0080	867	0.2610	---	0.0070	0.0060	0.1740	ok
16	0.0050	671	0.2610	---	0.0040	0.0030	0.1740	ok
17	0.0270	783	0.2610	---	0.0250	0.0230	0.1740	ok
18	0.0050	703	0.2610	---	0.0040	0.0030	0.1740	ok
19	0.0500	139	0.2610	---	0.0480	0.0440	0.1740	ok
20	0.0040	49	0.2610	---	0.0030	0.0030	0.1740	ok
21	0.0080	435	0.2610	---	0.0070	0.0060	0.1740	ok
22	0.0040	349	0.2610	---	0.0030	0.0030	0.1740	ok
23	0.0200	272	0.2610	---	0.0190	0.0170	0.1740	ok
24	0.0040	380	0.2610	---	0.0030	0.0030	0.1740	ok
25	0.0410	727	0.2610	---	0.0400	0.0370	0.1740	ok
26	0.0040	575	0.2610	---	0.0030	0.0030	0.1740	ok
27	0.0070	761	0.2610	---	0.0060	0.0050	0.1740	ok
28	0.0040	690	0.2610	---	0.0030	0.0030	0.1740	ok
29	0.0280	171	0.2610	---	0.0270	0.0250	0.1740	ok
30	0.0040	848	0.2610	---	0.0030	0.0030	0.1740	ok
31	0.0220	77	0.2610	---	0.0210	0.0190	0.1740	ok
32	0.0030	721	0.2610	---	0.0030	0.0020	0.1740	ok
33	0.0080	653	0.2610	---	0.0070	0.0070	0.1740	ok
34	0.0030	348	0.2610	---	0.0020	0.0020	0.1740	ok
35	0.0100	19	0.2610	---	0.0090	0.0090	0.1740	ok
36	0.0020	349	0.2610	---	0.0020	0.0020	0.1740	ok
37	0.0160	763	0.2610	---	0.0150	0.0140	0.1740	ok
38	0.0020	236	0.2610	---	0.0020	0.0010	0.1740	ok
39	0.0040	33	0.2610	---	0.0040	0.0030	0.1740	ok
40	0.0020	875	0.2610	---	0.0020	0.0010	0.1740	ok

* limits at minimum Rsce = 33

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

Nr. 12TH0259_EN50438-2013_0

Voltage fluctuation and Flicker.					
	Maximum permissible flicker and voltage fluctuation as per EN 61000-3-3/-3-11				
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%	0%	0%

DC-Injection.				
Protection limit	Tested at four power levels, limit 0,5% of IAC _{nom}			
Output power	~20%	~50%	75%	~100%
Max. test value (phase L1) [mA]	7,11	9,79	10,93	8,09
Max. test value (phase L1) [%]	0,10	0,13	0,15	0,11
Max. test value (phase L2) [mA]	1,82	1,77	1,80	0,74
Max. test value (phase L2) [%]	0,02	0,02	0,02	0,01
Max. test value (phase L3) [mA]	3,10	6,79	6,52	3,15
Max. test value (phase L3) [%]	0,04	0,09	0,09	0,04