Certificate of compliance

Applicant: **SMA Solar Technology AG**
Sonnenallee 1
34266 Niestetal
Germany

Product: **Grid-tied photovoltaic (PV) inverter**

Model: **STP3.0-3AV-40**
STP4.0-3AV-40
STP5.0-3AV-40
STP6.0-3AV-40

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: **PV180706N006**
Certificate number: **U18-0433**
Date of issue: **2018-08-20**

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. PV180706N006**

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	STP3.0-3AV-40	STP4.0-3AV-40	STP5.0-3AV-40	STP6.0-3AV-40
Maximum rated capacity	3 kW	4 kW	5 kW	6 kW
Rated voltage	230/400V	230/400V	230/400V	230/400V
Firmware version	V2.10.2			
Measurement period:	2018-07-06 to 2018-07-19			
Description of the structure of the power generation unit: 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.				

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

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*	254,7	1,998 / 554*
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,2	0,182
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,1	1,482

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	1,983 / 542*
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,3	0,183
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,3	1,484

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	1,998 / 534*
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,4	0,179
Under-voltage stage 1	195,5	1,5	195,5	1,5	195,4	1,482

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.

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

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	52,0	0,490
Under-frequency	47,5	0,5	47,5	0,5	47,5	0,494

Note.
Minimum operation time according to default interface protection:
Over-frequency 0,5 s
Under-frequency 0,5 s

LoM test STP6.0-3AV-40						
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]	128	138	169	114	108	142
Trip time. Phase 2 fuse removed [ms]	128	138	169	114	108	142
Trip time. Phase 3 fuse removed [ms]	128	138	169	114	108	142
LoM test STP3.0-3AV-40						
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]	139	129	134	148	113	148
Trip time. Phase 2 fuse removed [ms]	139	129	134	148	113	148
Trip time. Phase 3 fuse removed [ms]	139	129	134	148	113	148

Appendix E Type Verification Test Report	
Extract from test report according to EN 50438	**Nr. PV180706N006**

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 [kW]	Cos φ [1]
1	195,62	47,50	5,348	0,9984
2	253,00	51,50	5,997	0,9995

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]:	6,012	6,012	6,013
ΔP/PM [%] per 1 Hz:			0,001

Power response to over-frequency							
STP6.0-3AV-40							
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]:	6,000	5,895	4,813	3,730	4,813	5,895	6,000
PE60 [kW]:	6,016	5,924	4,819	3,690	4,825	5,931	6,015
ΔPE60/PM [%]:	0,39	0,73	0,16	1,00	0,31	0,91	0,37
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]:	3,000	2,953	2,411	1,868	2,411	2,953	3,000
PE60 [kW]:	3,014	2,971	2,392	1,877	2,431	2,979	3,013
ΔPE60/PM [%]:	0,34	0,45	0,46	0,24	0,51	0,64	0,33
Limit ΔP/P1min:	+ 10 % of P_M						

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power response to over-frequency							
STP3.0-3AV-40							
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]:	3,000	2,949	2,407	1,866	2,407	2,949	3,000
PE60 [kW]:	3,009	2,922	2,404	1,862	2,412	2,954	3,027
ΔPE60/PM [%]:	0,22	0,68	0,08	0,11	0,11	0,11	0,68
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]:	1,500	1,490	1,217	943	1,217	1,490	1,500
PE60 [kW]:	1,521	1,502	1,225	947	1,232	1,509	1,521
ΔPE60/PM [%]:	0,52	0,29	0,20	0,11	0,38	0,47	0,52
Limit ΔP/P1min:	+ 10 % of P_M						

Reactive power			
Uncontrollable reactive power			
STP6.0-3AV-40			
Test Voltage / Output power	**211,6V**	**230V**	**248,4V**
25% PN	0,9983	0,9990	0,9985
50% PN	0,9995	0,9997	0,9996
75% PN	0,9997	0,9998	0,9997
100% PN	0,9997	0,9998	0,9998
Limit	**>0,95**	**>0,95**	**>0,95**
STP3.0-3AV-40			
Test Voltage / Output power	**211,6V**	**230V**	**248,4V**
25% PN	0,9952	0,9956	0,9926
50% PN	0,9984	0,9990	0,9987
75% PN	0,9992	0,9996	0,9994
100% PN	0,9992	0,9997	0,9995
Limit	**>0,95**	**>0,95**	**>0,95**

Appendix E Type Verification Test Report

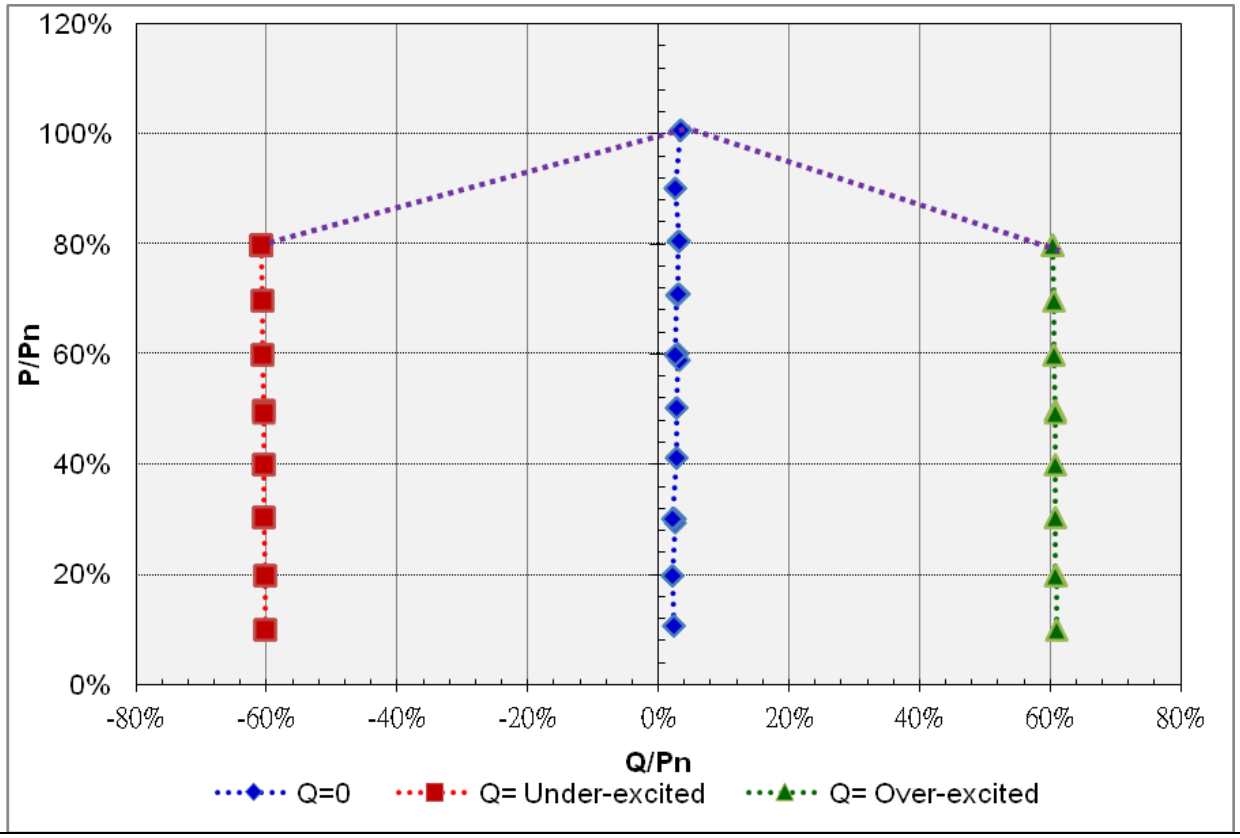
Extract from test report according to EN 50438 **Nr. PV180706N006**

Controllable reactive power (fix Q)				
Inductive (supply reactive power)				
STP6.0-3AV-40				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,589	-3,613	0,161	230,13
10% - 20%	1,192	-3,616	0,313	230,17
20% - 30%	1,823	-3,619	0,450	230,20
30% - 40%	2,400	-3,625	0,552	230,23
40% - 50%	2,962	-3,631	0,632	230,27
50% - 60%	3,598	-3,635	0,703	230,30
60% - 70%	4,183	-3,641	0,754	230,33
70% - 80%	4,794	-3,645	0,796	230,36
80% - 90%	4,794	-3,646	0,796	230,36
90% - 100%	4,793	-3,646	0,796	230,36
Capacitive (supply reactive power)				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,601	3,656	0,162	230,16
10% - 20%	1,204	3,653	0,313	230,19
20% - 30%	1,778	3,649	0,438	230,23
30% - 40%	2,384	3,647	0,547	230,26
40% - 50%	3,059	3,642	0,643	230,32
50% - 60%	3,606	3,639	0,704	230,34
60% - 70%	4,209	3,635	0,757	230,37
70% - 80%	4,861	3,626	0,802	230,37
80% - 90%	4,860	3,626	0,801	230,37
90% - 100%	4,860	3,627	0,801	230,37
Reactive power supply with set point Q=0				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,638	0,137	0,978	230,17
10% - 20%	1,188	0,132	0,994	230,17
20% - 30%	1,808	0,135	0,997	230,21
30% - 40%	2,472	0,166	0,998	230,22
40% - 50%	3,020	0,167	0,998	230,25
50% - 60%	3,591	0,155	0,999	230,27
60% - 70%	4,251	0,186	0,999	230,30
70% - 80%	4,837	0,187	0,999	230,32
80% - 90%	5,402	0,158	1,000	230,35
90% - 100%	6,045	0,211	0,999	230,39

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Diagram of inductive reactive power absorption



Appendix E Type Verification Test Report

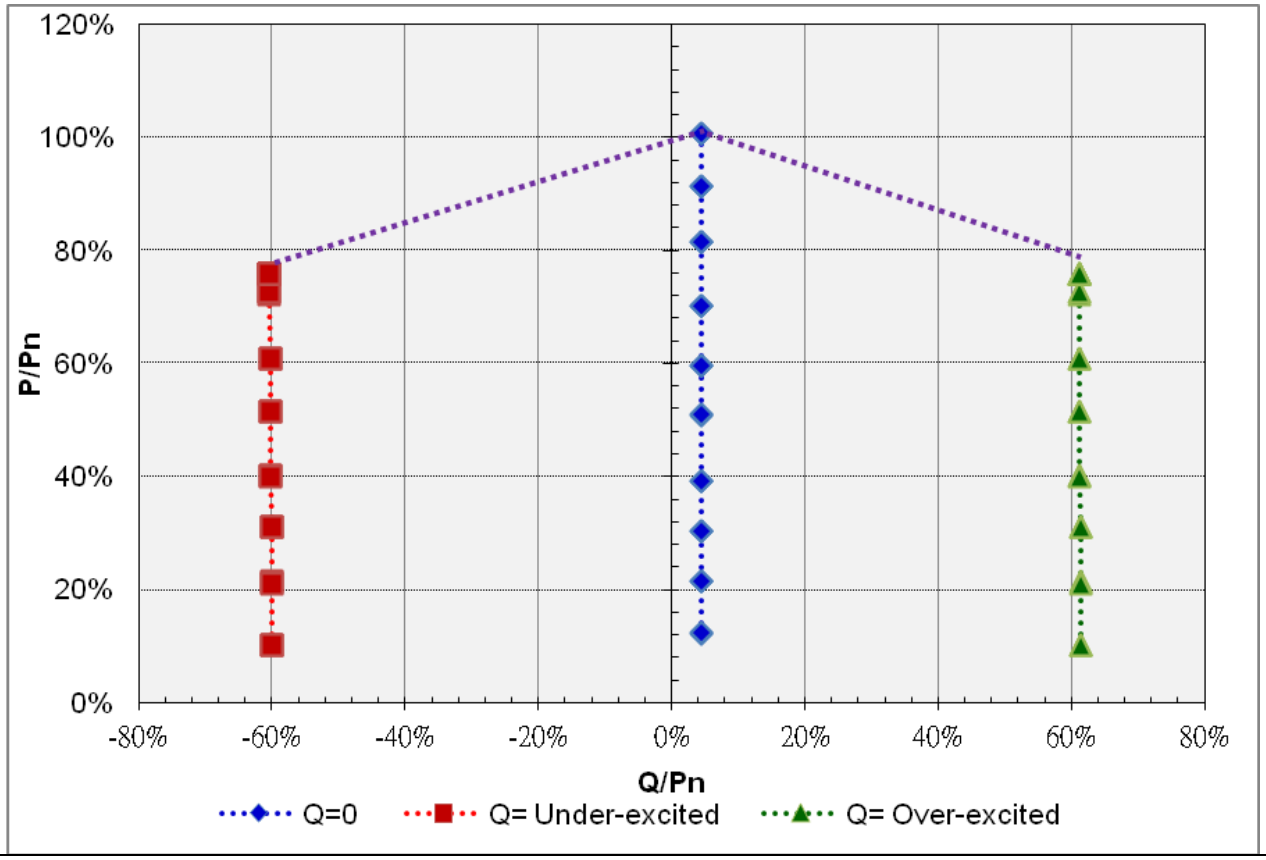
Extract from test report according to EN 50438 **Nr. PV180706N006**

Controllable reactive power (fix Q)				
Inductive (supply reactive power)				
STP3.0-3AV-40				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,305	-1,798	0,167	230,11
10% - 20%	0,627	-1,800	0,329	230,14
20% - 30%	0,932	-1,802	0,459	230,16
30% - 40%	1,202	-1,804	0,554	230,17
40% - 50%	1,546	-1,807	0,650	230,20
50% - 60%	1,826	-1,808	0,710	230,22
60% - 70%	2,177	-1,810	0,769	230,23
70% - 80%	2,276	-1,810	0,783	230,24
80% - 90%	2,276	-1,810	0,783	230,24
90% - 100%	2,276	-1,810	0,783	230,24
Capacitive (supply reactive power)				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,306	1,844	0,163	230,22
10% - 20%	0,639	1,842	0,328	230,24
20% - 30%	0,898	1,841	0,438	230,24
30% - 40%	1,267	1,839	0,567	230,18
40% - 50%	1,517	1,837	0,637	230,20
50% - 60%	1,802	1,837	0,700	230,22
60% - 70%	2,114	1,836	0,755	230,24
70% - 80%	2,433	1,833	0,799	230,27
80% - 90%	2,433	1,833	0,799	230,30
90% - 100%	2,432	1,833	0,799	230,31
Reactive power supply with set point Q=0				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,372	0,135	0,940	230,18
10% - 20%	0,643	0,137	0,978	230,18
20% - 30%	0,908	0,134	0,989	230,20
30% - 40%	1,179	0,132	0,994	230,22
40% - 50%	1,530	0,132	0,996	230,24
50% - 60%	1,791	0,132	0,997	230,25
60% - 70%	2,105	0,131	0,998	230,27
70% - 80%	2,448	0,131	0,999	230,27
80% - 90%	2,741	0,131	0,999	230,29
90% - 100%	3,020	0,132	0,999	230,32

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Diagram of inductive reactive power absorption



Appendix E Type Verification Test Report

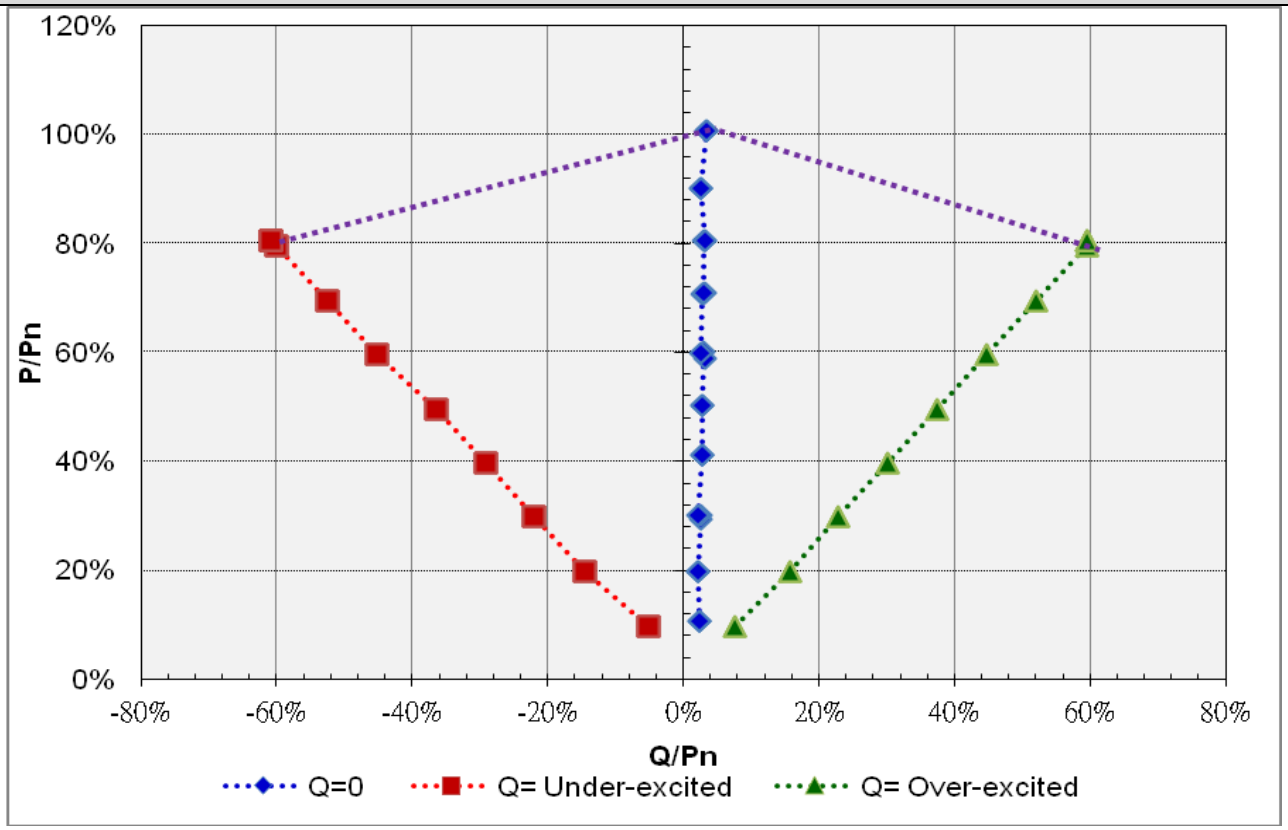
Extract from test report according to EN 50438 **Nr. PV180706N006**

Controllable reactive power (Fix PF)				
Inductive (supply reactive power)				
STP6.0-3AV-40				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,585	-0,308	0,802	230,18
10% - 20%	1,186	-0,876	0,804	230,23
20% - 30%	1,784	-1,326	0,803	230,29
30% - 40%	2,382	-1,753	0,805	230,35
40% - 50%	2,978	-2,182	0,807	230,36
50% - 60%	3,574	-2,706	0,797	230,35
60% - 70%	4,172	-3,152	0,798	230,44
70% - 80%	4,771	-3,600	0,798	230,47
80% - 90%	4,830	-3,646	0,798	230,46
90% - 100%	4,831	-3,646	0,798	230,47
Capacitive (supply reactive power)				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,600	0,455	0,796	230,27
10% - 20%	1,223	0,938	0,793	230,37
20% - 30%	1,839	1,367	0,803	230,48
30% - 40%	2,452	1,803	0,806	230,40
40% - 50%	3,065	2,241	0,807	230,51
50% - 60%	3,678	2,682	0,808	230,57
60% - 70%	4,291	3,124	0,808	230,51
70% - 80%	4,904	3,568	0,809	230,52
80% - 90%	4,904	3,568	0,809	230,53
90% - 100%	4,904	3,568	0,809	230,53
Reactive power supply with set point (cos φ = 1)				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,638	0,137	0,978	230,17
10% - 20%	1,188	0,132	0,994	230,17
20% - 30%	1,808	0,135	0,997	230,21
30% - 40%	2,472	0,166	0,998	230,22
40% - 50%	3,020	0,167	0,998	230,25
50% - 60%	3,591	0,155	0,999	230,27
60% - 70%	4,251	0,186	0,999	230,30
70% - 80%	4,837	0,187	0,999	230,32
80% - 90%	5,402	0,158	1,000	230,35
90% - 100%	6,045	0,211	0,999	230,39

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Diagram of inductive reactive power absorption



Appendix E Type Verification Test Report

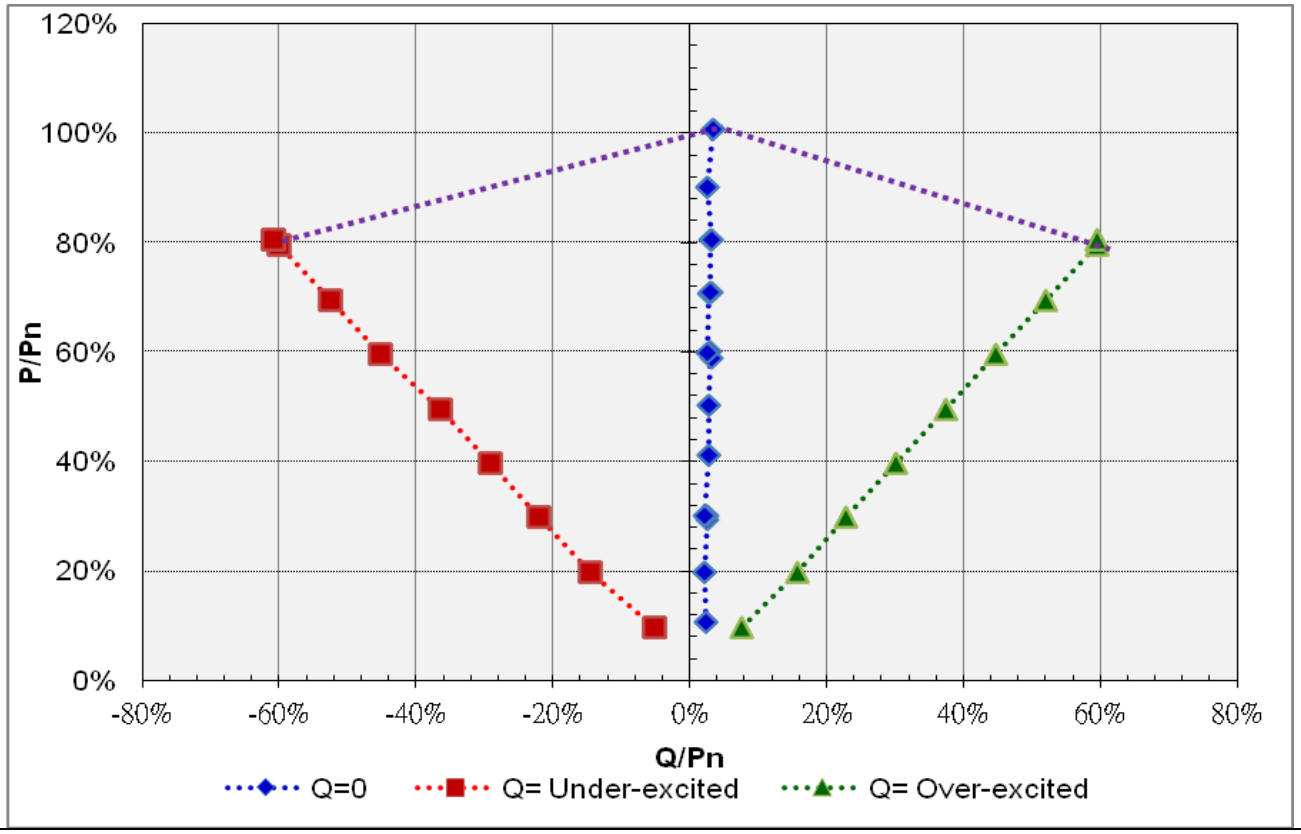
Extract from test report according to EN 50438 **Nr. PV180706N006**

Controllable reactive power (Fix PF)				
Inductive (supply reactive power)				
STP3.0-3AV-40				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,281	0,377	0,594	230,20
10% - 20%	0,588	-0,543	0,735	230,20
20% - 30%	0,892	-0,741	0,769	230,20
30% - 40%	1,195	-0,954	0,782	230,22
40% - 50%	1,497	-1,173	0,787	230,23
50% - 60%	1,798	-1,396	0,790	230,26
60% - 70%	2,100	-1,621	0,792	230,28
70% - 80%	2,402	-1,846	0,793	230,26
80% - 90%	2,402	-1,846	0,793	230,26
90% - 100%	2,402	-1,846	0,793	230,26
Capacitive (supply reactive power)				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,287	0,404	0,579	230,12
10% - 20%	0,674	0,525	0,789	230,19
20% - 30%	0,909	0,768	0,764	230,17
30% - 40%	1,217	0,976	0,780	230,20
40% - 50%	1,524	1,190	0,788	230,23
50% - 60%	1,830	1,408	0,793	230,26
60% - 70%	2,136	1,627	0,796	230,29
70% - 80%	2,439	1,824	0,801	230,29
80% - 90%	2,439	1,824	0,801	230,29
90% - 100%	2,439	1,824	0,801	230,28
Reactive power supply with set point (cos φ = 1)				
Power-BIN	**Active power [kW]**	**Reactive power [kVar]**	**Power factor (cos φ)**	**AC voltage [V]**
0% - 10%	0,372	0,135	0,940	230,18
10% - 20%	0,643	0,137	0,978	230,18
20% - 30%	0,908	0,134	0,989	230,20
30% - 40%	1,179	0,132	0,994	230,22
40% - 50%	1,530	0,132	0,996	230,24
50% - 60%	1,791	0,132	0,997	230,25
60% - 70%	2,105	0,131	0,998	230,27
70% - 80%	2,448	0,131	0,999	230,27
80% - 90%	2,741	0,131	0,999	230,29
90% - 100%	3,020	0,132	0,999	230,32

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Diagram of inductive reactive power absorption



Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Q adjustment				
STP6.0-3AV-40	**Reactive power set point Q [kVar]**	**Measured reactive power Q [kVar]**	**Measured cos φ**	**Deviation compared to setpoint ΔQ / PN [%]**
- Qmin	-3,600	-3,660	0,7952	1,00%
0	0	0,211	0,9994	3,51%
+ Qmax	+3,600	3,620	0,8024	0,33%
STP3.0-3AV-40	**Reactive power set point Q [kVar]**	**Measured reactive power Q [kVar]**	**Measured cos φ**	**Deviation compared to setpoint ΔQ / PN [%]**
- Qmin	-1,800	-1,811	0,7822	0,37%
0	0	0,132	0,9990	4,41%
+ Qmax	+1,800	1,831	0,7982	1,02%

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Connection and starting to generate electrical power		
Test according EN 50438 with standard setting	**Min. voltage for connection to grid:**	195,5
	Max. voltage for connection to grid:	253,0
	Min. frequency for connection to grid:	47,50
	Max. frequency for connection to grid:	50,05
	Observation time (≥60s)	60s

Test		
	Voltage conditions	
a) Start up for voltage range	**<85% Un for twice of observation time**	**>110% Un for twice of observation time**
Connection:	No connection	No connection
Limit:	No connection allowed	
b) In voltage range at start-up	**≥85% Un within twice setting observation time**	**≤110% Un within twice setting observation time**
Reconnection time [s]	62,6	62,0
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	**≥85% Un for twice of setting observation time**	**≤110% Un for twice of setting observation time**
Reconnection time [s]	65,6	64,0
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	**<47,50 Hz for twice of setting observation time**	**>50,10 Hz for twice of setting observation time**
Connection:	No connection	No connection
Limit	No connection allowed	
e) In frequency range at start-up	**≥47,50 Hz within twice of setting observation time**	**≤50,10 Hz within twice of setting observation time**
Reconnection time [s]	64,0	61,0
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	**≥47,50 Hz for twice of setting observation time**	**≤50,05 Hz for twice of setting observation time**
Reconnection time [s]	65,0	61,0
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. PV180706N006**

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	34,586	2,5603
Initial Value of aperiodic current	A	N/A	100ms	--	--
Initial symmetrical short-circuit current*	I_k	N/A	250ms	--	--
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	--	--
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,0081	In seconds

Short-circuit current parameters 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	33,876	3,1947
Initial Value of aperiodic current	A	N/A	100ms	--	--
Initial symmetrical short-circuit current*	I_k	N/A	250ms	--	--
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	--	--
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,0072	In seconds

Short-circuit current parameters 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	25,866	1,9754
Initial Value of aperiodic current	A	N/A	100ms	--	--
Initial symmetrical short-circuit current*	I_k	N/A	250ms	--	--
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	--	--
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,0073	In seconds

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power Quality. Harmonic current emission				
micro-generator		STP6.0-3AV-40		
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	8,708	--	Phase 1	-
2nd	0,016	0,19%	Phase 1	1,080
3rd	0,377	4,33%	Phase 1	2,300
4th	0,204	2,34%	Phase 1	0,430
5th	0,144	1,66%	Phase 1	1,140
6th	0,163	1,87%	Phase 1	0,300
7th	0,135	1,55%	Phase 1	0,770
8th	0,089	1,03%	Phase 1	0,230
9th	0,184	2,11%	Phase 1	0,400
10th	0,080	0,92%	Phase 1	0,184
11th	0,319	3,67%	Phase 1	0,330
12th	0,071	0,81%	Phase 1	0,153
13th	0,207	2,38%	Phase 1	0,210
14th	0,013	0,14%	Phase 1	0,131
15th	0,020	0,23%	Phase 1	0,150
16th	0,010	0,11%	Phase 1	0,115
17th	0,045	0,52%	Phase 1	0,132
18th	0,006	0,07%	Phase 1	0,102
19th	0,044	0,50%	Phase 1	0,118
20th	0,006	0,07%	Phase 1	0,092
21th	0,015	0,17%	Phase 1	0,107
22th	0,008	0,09%	Phase 1	0,084
23th	0,035	0,40%	Phase 1	0,098
24th	0,005	0,06%	Phase 1	0,077
25th	0,019	0,22%	Phase 1	0,090
26th	0,005	0,06%	Phase 1	0,071
27th	0,012	0,14%	Phase 1	0,083
28th	0,006	0,07%	Phase 1	0,066
29th	0,013	0,15%	Phase 1	0,078
30th	0,004	0,05%	Phase 1	0,061
31th	0,022	0,26%	Phase 1	0,073
32th	0,005	0,05%	Phase 1	0,058
33th	0,008	0,10%	Phase 1	0,068
34th	0,004	0,05%	Phase 1	0,054
35th	0,022	0,25%	Phase 1	0,064
36th	0,004	0,04%	Phase 1	0,051
37th	0,010	0,12%	Phase 1	0,061
38th	0,004	0,05%	Phase 1	0,048
39th	0,008	0,10%	Phase 1	0,058
40th	0,004	0,04%	Phase 1	0,046

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power Quality. Harmonic current emission				
micro-generator		STP6.0-3AV-40		
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	8,708	--	Phase 2	-
2nd	0,032	0,36%	Phase 2	1,080
3rd	0,353	4,06%	Phase 2	2,300
4th	0,192	2,20%	Phase 2	0,430
5th	0,133	1,52%	Phase 2	1,140
6th	0,154	1,76%	Phase 2	0,300
7th	0,124	1,42%	Phase 2	0,770
8th	0,073	0,84	Phase 2	0,230
9th	0,174	2,00%	Phase 2	0,400
10th	0,074	0,84%	Phase 2	0,184
11th	0,277	3,18%	Phase 2	0,330
12th	0,067	0,77%	Phase 2	0,153
13th	0,168	1,93%	Phase 2	0,210
14th	0,014	0,16%	Phase 2	0,131
15th	0,017	0,20%	Phase 2	0,150
16th	0,011	0,13%	Phase 2	0,115
17th	0,040	0,46%	Phase 2	0,132
18th	0,006	0,07%	Phase 2	0,102
19th	0,040	0,46%	Phase 2	0,118
20th	0,007	0,08%	Phase 2	0,092
21th	0,014	0,16%	Phase 2	0,107
22th	0,010	0,11%	Phase 2	0,084
23th	0,031	0,36%	Phase 2	0,098
24th	0,005	0,06%	Phase 2	0,077
25th	0,019	0,22%	Phase 2	0,090
26th	0,006	0,07%	Phase 2	0,071
27th	0,009	0,11%	Phase 2	0,083
28th	0,007	0,08%	Phase 2	0,066
29th	0,015	0,17%	Phase 2	0,078
30th	0,004	0,05%	Phase 2	0,061
31th	0,020	0,22%	Phase 2	0,073
32th	0,005	0,06%	Phase 2	0,058
33th	0,006	0,07%	Phase 2	0,068
34th	0,004	0,05%	Phase 2	0,054
35th	0,018	0,20%	Phase 2	0,064
36th	0,004	0,04%	Phase 2	0,051
37th	0,009	0,10%	Phase 2	0,061
38th	0,005	0,06%	Phase 2	0,048
39th	0,006	0,07%	Phase 2	0,058
40th	0,004	0,04%	Phase 2	0,046

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power Quality. Harmonic current emission				
micro-generator		STP6.0-3AV-40		
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	8,712	--	Phase 3	-
2nd	0,022	0,26%	Phase 3	1,080
3rd	0,367	4,21%	Phase 3	2,300
4th	0,199	2,28%	Phase 3	0,430
5th	0,135	1,55%	Phase 3	1,140
6th	0,149	1,71%	Phase 3	0,300
7th	0,130	1,49%	Phase 3	0,770
8th	0,071	0,81%	Phase 3	0,230
9th	0,171	1,97%	Phase 3	0,400
10th	0,074	0,84%	Phase 3	0,184
11th	0,263	3,02%	Phase 3	0,330
12th	0,066	0,76%	Phase 3	0,153
13th	0,174	2,00%	Phase 3	0,210
14th	0,013	0,15%	Phase 3	0,131
15th	0,023	0,26%	Phase 3	0,150
16th	0,010	0,11%	Phase 3	0,115
17th	0,049	0,57%	Phase 3	0,132
18th	0,007	0,08%	Phase 3	0,102
19th	0,043	0,49%	Phase 3	0,118
20th	0,007	0,08%	Phase 3	0,092
21th	0,011	0,12%	Phase 3	0,107
22th	0,008	0,09%	Phase 3	0,084
23th	0,031	0,36%	Phase 3	0,098
24th	0,006	0,06%	Phase 3	0,077
25th	0,023	0,27%	Phase 3	0,090
26th	0,005	0,06%	Phase 3	0,071
27th	0,008	0,09%	Phase 3	0,083
28th	0,006	0,06%	Phase 3	0,066
29th	0,017	0,20%	Phase 3	0,078
30th	0,004	0,05%	Phase 3	0,061
31th	0,017	0,20%	Phase 3	0,073
32th	0,005	0,06%	Phase 3	0,058
33th	0,007	0,08%	Phase 3	0,068
34th	0,004	0,05%	Phase 3	0,054
35th	0,017	0,20%	Phase 3	0,064
36th	0,004	0,04%	Phase 3	0,051
37th	0,012	0,14%	Phase 3	0,061
38th	0,005	0,05%	Phase 3	0,048
39th	0,007	0,08%	Phase 3	0,058
40th	0,004	0,04%	Phase 3	0,046

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power Quality. Harmonic current emission				
micro-generator		STP3.0-3AV-40		
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	4,221	--	Phase 1	-
2nd	0,016	0,38%	Phase 1	1,080
3rd	0,027	0,64%	Phase 1	2,300
4th	0,015	0,35%	Phase 1	0,430
5th	0,012	0,29%	Phase 1	1,140
6th	0,012	0,28%	Phase 1	0,300
7th	0,012	0,28%	Phase 1	0,770
8th	0,007	0,16%	Phase 1	0,230
9th	0,020	0,47%	Phase 1	0,400
10th	0,007	0,16%	Phase 1	0,184
11th	0,046	1,08%	Phase 1	0,330
12th	0,005	0,12%	Phase 1	0,153
13th	0,027	0,64%	Phase 1	0,210
14th	0,006	0,14%	Phase 1	0,131
15th	0,013	0,31%	Phase 1	0,150
16th	0,004	0,10%	Phase 1	0,115
17th	0,027	0,64%	Phase 1	0,132
18th	0,003	0,08%	Phase 1	0,102
19th	0,023	0,55%	Phase 1	0,118
20th	0,003	0,07%	Phase 1	0,092
21th	0,006	0,14%	Phase 1	0,107
22th	0,003	0,07%	Phase 1	0,084
23th	0,017	0,41%	Phase 1	0,098
24th	0,003	0,06%	Phase 1	0,077
25th	0,012	0,28%	Phase 1	0,090
26th	0,002	0,05%	Phase 1	0,071
27th	0,005	0,13%	Phase 1	0,083
28th	0,002	0,06%	Phase 1	0,066
29th	0,008	0,18%	Phase 1	0,078
30th	0,002	0,05%	Phase 1	0,061
31th	0,010	0,24%	Phase 1	0,073
32th	0,002	0,05%	Phase 1	0,058
33th	0,005	0,11%	Phase 1	0,068
34th	0,002	0,05%	Phase 1	0,054
35th	0,011	0,25%	Phase 1	0,064
36th	0,002	0,04%	Phase 1	0,051
37th	0,007	0,16%	Phase 1	0,061
38th	0,002	0,05%	Phase 1	0,048
39th	0,004	0,10%	Phase 1	0,058
40th	0,002	0,04%	Phase 1	0,046

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power Quality. Harmonic current emission				
micro-generator		STP3.0-3AV-40		
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	4,219	--	Phase 2	-
2nd	0,032	0,75%	Phase 2	1,080
3rd	0,024	0,57%	Phase 2	2,300
4th	0,012	0,29%	Phase 2	0,430
5th	0,012	0,28%	Phase 2	1,140
6th	0,010	0,23%	Phase 2	0,300
7th	0,011	0,26%	Phase 2	0,770
8th	0,016	0,38%	Phase 2	0,230
9th	0,009	0,22%	Phase 2	0,400
10th	0,006	0,15%	Phase 2	0,184
11th	0,042	1,00%	Phase 2	0,330
12th	0,003	0,08%	Phase 2	0,153
13th	0,039	0,93%	Phase 2	0,210
14th	0,007	0,16%	Phase 2	0,131
15th	0,007	0,17%	Phase 2	0,150
16th	0,006	0,13%	Phase 2	0,115
17th	0,018	0,43%	Phase 2	0,132
18th	0,003	0,07%	Phase 2	0,102
19th	0,020	0,49%	Phase 2	0,118
20th	0,003	0,08%	Phase 2	0,092
21th	0,009	0,21%	Phase 2	0,107
22th	0,004	0,11%	Phase 2	0,084
23th	0,018	0,42%	Phase 2	0,098
24th	0,002	0,06%	Phase 2	0,077
25th	0,007	0,17%	Phase 2	0,090
26th	0,002	0,06%	Phase 2	0,071
27th	0,006	0,15%	Phase 2	0,083
28th	0,003	0,08%	Phase 2	0,066
29th	0,005	0,13%	Phase 2	0,078
30th	0,002	0,04%	Phase 2	0,061
31th	0,012	0,29%	Phase 2	0,073
32th	0,002	0,06%	Phase 2	0,058
33th	0,004	0,09%	Phase 2	0,068
34th	0,002	0,05%	Phase 2	0,054
35th	0,011	0,26%	Phase 2	0,064
36th	0,002	0,04%	Phase 2	0,051
37th	0,004	0,09%	Phase 2	0,061
38th	0,002	0,06%	Phase 2	0,048
39th	0,004	0,09%	Phase 2	0,058
40th	0,002	0,05%	Phase 2	0,046

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

Power Quality. Harmonic current emission				
micro-generator		STP3.0-3AV-40		
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	4,224	--	Phase 3	-
2nd	0,022	0,53%	Phase 3	1,080
3rd	0,017	0,39%	Phase 3	2,300
4th	0,010	0,23%	Phase 3	0,430
5th	0,007	0,16%	Phase 3	1,140
6th	0,015	0,34%	Phase 3	0,300
7th	0,005	0,11%	Phase 3	0,770
8th	0,018	0,43%	Phase 3	0,230
9th	0,012	0,29%	Phase 3	0,400
10th	0,006	0,15%	Phase 3	0,184
11th	0,056	1,32%	Phase 3	0,330
12th	0,005	0,11%	Phase 3	0,153
13th	0,033	0,79%	Phase 3	0,210
14th	0,008	0,18%	Phase 3	0,131
15th	0,010	0,23%	Phase 3	0,150
16th	0,006	0,14%	Phase 3	0,115
17th	0,022	0,53%	Phase 3	0,132
18th	0,003	0,08%	Phase 3	0,102
19th	0,019	0,46%	Phase 3	0,118
20th	0,004	0,10%	Phase 3	0,092
21th	0,005	0,11%	Phase 3	0,107
22th	0,005	0,12%	Phase 3	0,084
23th	0,014	0,33%	Phase 3	0,098
24th	0,003	0,07%	Phase 3	0,077
25th	0,012	0,27%	Phase 3	0,090
26th	0,003	0,08%	Phase 3	0,071
27th	0,003	0,07%	Phase 3	0,083
28th	0,003	0,08%	Phase 3	0,066
29th	0,009	0,22%	Phase 3	0,078
30th	0,002	0,05%	Phase 3	0,061
31th	0,007	0,17%	Phase 3	0,073
32th	0,003	0,07%	Phase 3	0,058
33th	0,003	0,06%	Phase 3	0,068
34th	0,002	0,05%	Phase 3	0,054
35th	0,007	0,16%	Phase 3	0,064
36th	0,002	0,04%	Phase 3	0,051
37th	0,005	0,12%	Phase 3	0,061
38th	0,003	0,06%	Phase 3	0,048
39th	0,002	0,06%	Phase 3	0,058
40th	0,002	0,04%	Phase 3	0,046

Appendix E Type Verification Test Report

Extract from test report according to EN 50438 **Nr. PV180706N006**

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	0,64	0,64	0,00%	0,00%	0,11%

DC-Injection.				
STP6.0-3AV-40				
Protection limit	Tested at four power levels, limit 0,5% of IAC_{nom} (43mA)			
Output power	**~20%**	**~50%**	**75%**	**~100%**
Max. test value (phase L1) [mA]	-13	-18	-31	-15
Max. test value (phase L2) [mA]	-5	-17	-20	-5
Max. test value (phase L3) [mA]	12	31	36	9

DC-Injection.				
STP3.0-3AV-40				
Protection limit	Tested at four power levels, limit 0,5% of IAC_{nom} (22mA)			
Output power	**~20%**	**~50%**	**75%**	**~100%**
Max. test value (phase L1) [mA]	-8	-9	-11	-21
Max. test value (phase L2) [mA]	-10	-7	-7	-9
Max. test value (phase L3) [mA]	8	-7	-11	21