



**BUREAU
VERITAS**

Uygunluk Belgesi

Başvuru Sahibi: KACO new energy GmbH
Carl-Zeiss-Straße 1
74172 Neckarsulm
Almanya

Ürün: Düşük şebeke voltajı ve jeneratör bağlantısını otomatik olarak kesme cihazı

Model: Powador 12.0TL3-INT
Powador 14.0TL3-INT
Powador 18.0TL3-INT
Powador 20.0TL3 INT
Blueplanet 20.0 TL3 M2 WM OD IIG0

Yönetmeliklere uygun kullanım:

EN 50438:2014, TS EN 50438:2014, DIN V VDE V 0126-1-1:2006-02, DIN V VDE V 0126-1-1/A1:2012-02 'ye uygun üç fazlı şebeke denetlemeli otomatik bağlantı kesme cihazı, ana şebekedeki bir inverter aracılığıyla paralel bağlanan üç fazlı fotovoltaik sistemler içindir. Otomatik bağlantı kesme cihazı sözü geçen inverterin tümleşik bir parçasıdır. Bu, ağ tedarikçisinin her zaman ulaşabileceği yalıtım işlevli bağlantı kesme cihazının yerini alır.

Geçerli kurallar ve standartlar:

EN 50438:2014, TS EN 50438:2014

Mikro jeneratörlerin alçak gerilim dağıtım şebekeleri ile paralel bağlanması için kurallar

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02

Düşük şebeke voltajı ve jeneratör bağlantısını otomatik olarak kesme cihazı

DIN V VDE V 0126-1-1/A1 (VDE V 0126-1-1/A1):2012-02

Düşük şebeke voltajı ve jeneratör bağlantısını otomatik olarak kesme cihazı, Değişiklik 1

Yukarıda bahsedilen temsili ürünün güvenlik özellikleri, bu belgenin tanzim tarihinde yönetmeliklere uygun olarak belirlenen kullanım için geçerli güvenlik özelliklerine uygundur.

Rapor numarası: 10TH0306-EN50438_0

Belge numarası: U16-0485

Tanzim tarihi: 2016-08-26

Sertifikasyon enstitüsü



Dieter Zitzmann



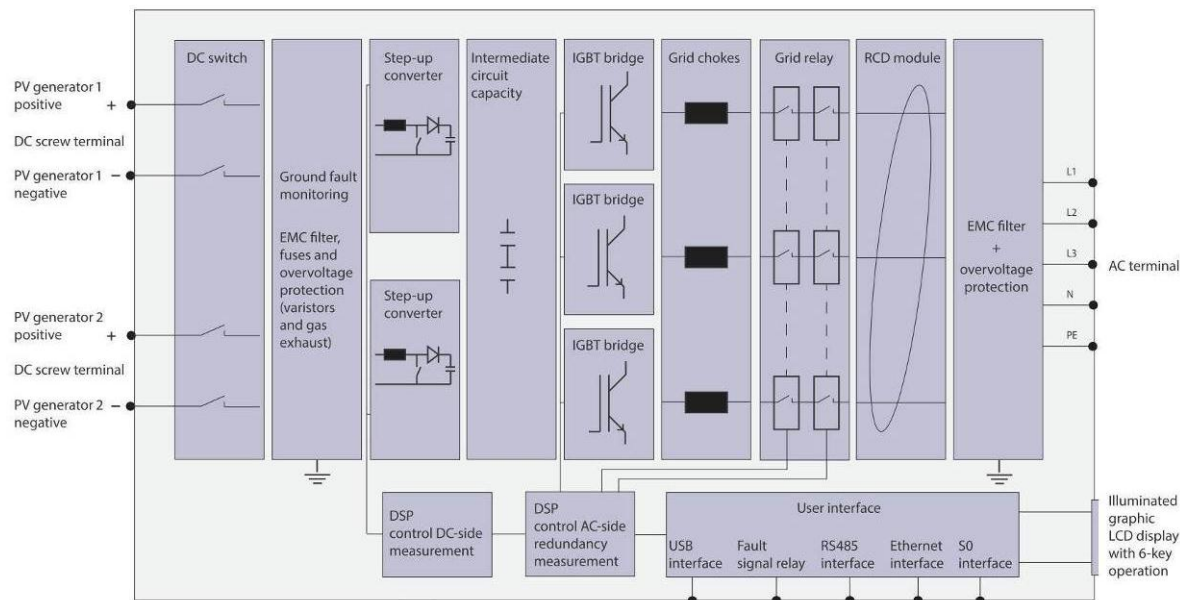
Deutsche
Akkreditierungsstelle
D-ZE-12024-01-00

Sertifikasyon enstitüsü Bureau Veritas Consumer Products Services Germany GmbH
göre akredite DIN EN ISO/IEC 17065

Appendix E Type Verification Test Report
 Extract from test report according to EN 50438 Nr. 10TH0306

Type Approval and declaration of compliance with the requirements of EN 50438.	
Manufacturer / applicant:	KACO new energy GmbH Carl-Zeiss-Straße 1 74172 Neckarsulm Germany
Micro-generator Type	Grid-tied photovoltaic inverter
Rated values	Powador 12.0TL3-INT Powador 14.0TL3-INT Powador 18.0TL3-INT Powador 20.0TL3 INT Blueplanet 20.0 TL3 M2 WM OD IIG0
Maximum rated capacity	Powador 12.0 TL3 : 10 kW Powador 14.0 TL3: 12,5 kW Powador 18.0 TL3 : 15 kW Powador 20.0 TL3: 17 kW Blueplanet 20.0 TL3 : 20 kW
Rated voltage	400 V _{AC} (P-P) / 230 V _{AC} (3/PEN), 50 Hz
Firmware version	PKT: v3.24; ARM: V3.82 3854(Rev. 10378); CFG: v5.1316 (25E3) DSP-AC: v2.06 B6C6(Rev. 3792); DSP-DC: v2.03 59AD (Rev. 808)
Measurement period:	2016-08-02 to 2016-08-26

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 thanks to the inverter bridge and two series-connected relays. 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

Blueplanet 20.0

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*	253,0	431*
Over-voltage stage 2	264,5	0,2	264,5	0,2	263,7	177
Under-voltage stage 1	195,5	1,5	195,5	1,5	196,4	1477

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*	253,0	431*
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,4	181
Under-voltage stage 1	195,5	1,5	195,5	1,5	197,0	1481

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*	253,0	431*
Over-voltage stage 2	264,5	0,2	264,5	0,2	264,6	174
Under-voltage stage 1	195,5	1,5	195,5	1,5	197,1	1474

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

*over-voltage-stage 1: 10 min-mean-value corresponding to EN 50160. The disconnection after a 10min mean value is detected 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	52,00	0,5	52,00	0,5	52,01	0,467
Under-frequency	47,50	0,5	47,50	0,5	47,50	0,485

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 L1 [ms]	184	170	164	185	201	188
Trip time L2 [ms]	184	170	164	185	201	188
Trip time L3 [ms]	184	170	164	185	201	188

Indicate additional shut down time included in above results.
(Integrated interface switch)

Type of switching equipment 1:
Relay with 20ms
Type of switching equipment 2:
Relay with 20ms

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]
Blueplanet 20.0				
1	195,5	47,49	18460	0,999
2	253,0	51,50	20086	0,999

Active power at under-frequency			
Blueplanet 20.0			
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	49,60	47,60
Active power [W]:	20,02	20,01	20,0
ΔP/PM [%] per 1 Hz:			0

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Power response to over-frequency

Powador 14.0

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
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1. Measurement a) to g): Active power output > 80% P_n

Frequency [Hz]:	49,98	50,24	50,68	51,13	50,68	50,23	49,98
PM [kW]:	N/A	14,82	12,13	9,44	12,13	14,81	N/A
PE60 [kW]:	15,04	14,88	12,48	9,86	12,37	14,80	15,05
ΔPE60/PM [%]:	N/A	0,37	2,32	2,78	1,57	-0,07	N/A

2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n

Frequency [Hz]:	49,98	50,24	50,68	51,13	50,68	50,23	49,98
PM [kW]:	N/A	7,49	6,13	4,77	6,13	7,48	N/A
PE60 [kW]:	7,60	7,11	5,85	4,55	5,77	7,04	8,30
ΔPE60/PM [%]:	N/A	-2,48	-1,87	-1,44	-2,38	-2,91	N/A

Limit ΔP/P1min: + 10 % of P_M

Reactive power

Uncontrollable reactive power

Blueplanet 20.0

Test Voltage	211,6V	230V	248,4V
Output power			
25% PN	0,999	0,999	0,998
50% PN	0,999	0,999	0,999
75% 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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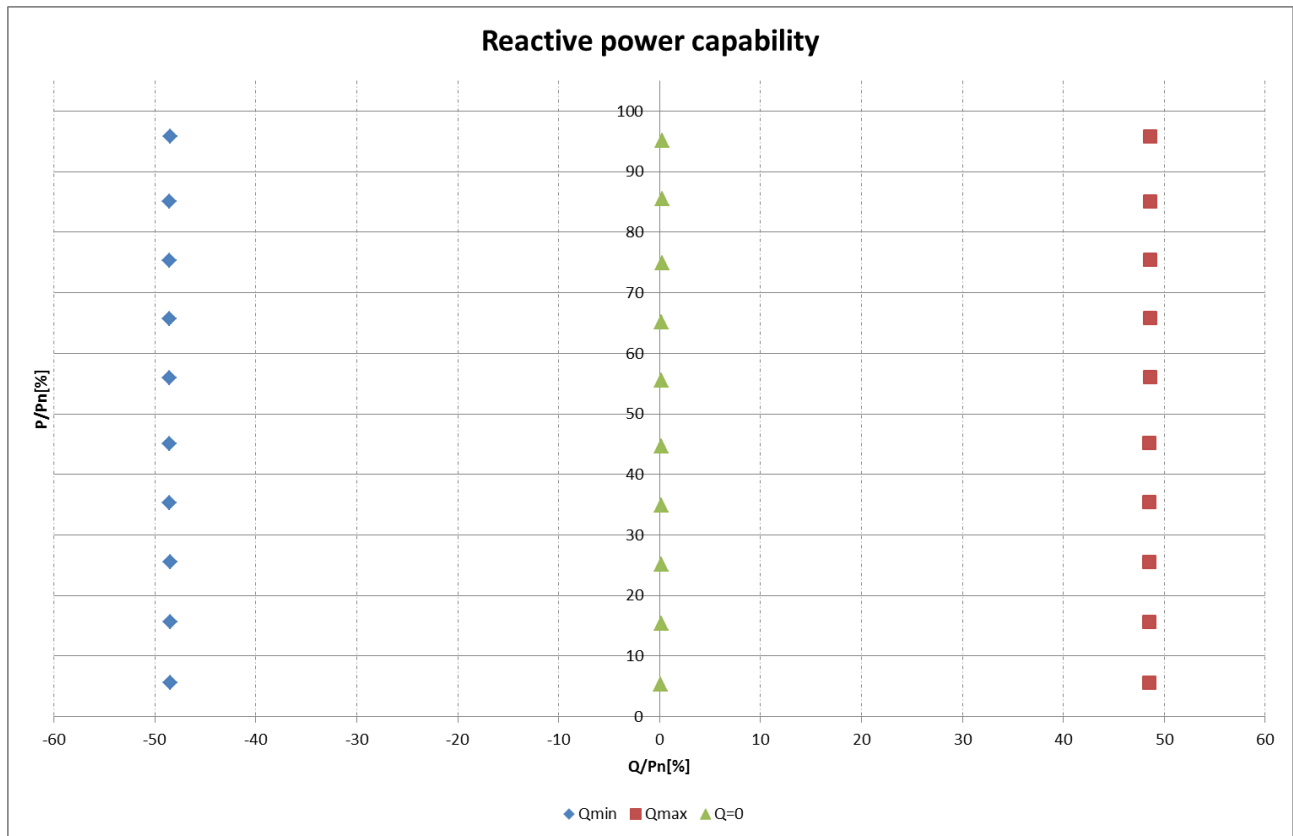
Controllable reactive power				
Blueplanet 20.0				
Inductive (supply reactive power)				
Power-BIN	Active power [W]	Reactive power [Var]	Power factor (cos φ)	DC power [W]
0% - 10%	1004,01	-8723,41	-0,11	1256,62
10% - 20%	2805,75	-8722,23	-0,31	3077,73
20% - 30%	4589,45	-8730,20	-0,47	4893,12
30% - 40%	6361,63	-8734,69	-0,59	6701,83
40% - 50%	8115,89	-8736,93	-0,68	8498,54
50% - 60%	10075,03	-8737,87	-0,76	10515,25
60% - 70%	11825,64	-8738,86	-0,80	12322,06
70% - 80%	13566,18	-8738,36	-0,84	14124,77
80% - 90%	15303,04	-8735,30	-0,87	15932,06
90% - 100%	17236,08	-8729,50	-0,89	17948,10
Capacitive (supply reactive power)				
Power-BIN	Active power [W]	Reactive power [Var]	Power factor (cos φ)	DC power [W]
0% - 10%	1013,26	8732,09	0,12	1247,56
10% - 20%	2814,76	8733,87	0,31	3067,26
20% - 30%	4603,47	8735,24	0,47	4885,63
30% - 40%	6377,62	8735,96	0,59	6696,12
40% - 50%	8132,24	8737,49	0,68	8494,89
50% - 60%	10091,17	8739,78	0,76	10508,49
60% - 70%	11841,03	8742,13	0,80	12316,39
70% - 80%	13582,34	8744,89	0,84	14123,94
80% - 90%	15319,83	8747,07	0,87	15928,07
90% - 100%	17245,45	8752,38	0,89	17940,75
Reactive power supply with set point Q=0				
Power-BIN	Active power [W]	Reactive power [Var]	Power factor (cos φ)	DC power [W]
0% - 10%	962,18	25,79	0,97	1060,43
10% - 20%	2754,84	29,64	0,99	2888,08
20% - 30%	4521,66	32,07	1,00	4694,71
30% - 40%	6287,98	33,55	1,00	6507,71
40% - 50%	8030,21	36,07	1,00	8298,33
50% - 60%	9981,73	38,57	1,00	10311,42
60% - 70%	11727,07	40,44	1,00	12120,94
70% - 80%	13470,27	44,48	1,00	13930,14
80% - 90%	15399,02	45,41	1,00	15939,91
90% - 100%	17132,19	52,29	1,00	17751,27

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Diagram of inductive reactive power absorption



Q adjustment				
	Reactive power set point Q [kVar]	Measured reactive power Q [kVar]	Measured $\cos \varphi$	Deviation compared to setpoint $\Delta Q / PN$ [%]
- Qmin	-48,43%	-48,51%	0,724	-0,08%
0	0,00%	0,18%	0,999	0,18%
+ Qmax	+48,43%	48,54%	0,719	0,11%

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Connection and starting to generate electrical power		
	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]	117	118
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. For recorded gradient see diagram below.	
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]	108	108
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.	
	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]	114	116
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. For recorded gradient see diagram below.	
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]	114	116
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.	

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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	64,82 V	24,77 A
Initial Value of aperiodic current	A	N/A	100ms	61,49 V	26,76 A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	61,20 V	27,66 A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	61,12 V	28,24 A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0,570 s	In seconds

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Extract from test report according to EN 50438 Nr. 10TH0306

Power Quality. Harmonic current emission					
EUT		KACO Blueplanet 20.0			
Harmonic order n	Current Magnitude [A] at 100% rated output power	% of Fundamental	Phase	Harmonic current limit EN61000-3-12 [%]	
				1 phase	3 phase
1st	27,928	100,000	Phase 1	-	-
2nd	0,063	0,226	Phase 1	8	8
3rd	0,036	0,130	Phase 1	21,6	N/A
4th	0,010	0,035	Phase 1	4	4
5th	0,027	0,097	Phase 1	10,7	10,7
6th	0,007	0,026	Phase 1	2,67	2,67
7th	0,052	0,187	Phase 1	7,2	7,2
8th	0,007	0,025	Phase 1	2	2
9th	0,017	0,060	Phase 1	3,8	N/A
10th	0,006	0,023	Phase 1	1,6	1,6
11th	0,040	0,144	Phase 1	3,1	3,1
12th	0,007	0,024	Phase 1	1,33	1,33
13th	0,030	0,109	Phase 1	2	2
14th	0,006	0,020	Phase 1	N/A	N/A
15th	0,019	0,068	Phase 1	N/A	N/A
16th	0,005	0,020	Phase 1	N/A	N/A
17th	0,022	0,080	Phase 1	N/A	N/A
18th	0,005	0,019	Phase 1	N/A	N/A
19th	0,026	0,094	Phase 1	N/A	N/A
20th	0,005	0,018	Phase 1	N/A	N/A
21th	0,016	0,057	Phase 1	N/A	N/A
22th	0,005	0,018	Phase 1	N/A	N/A
23th	0,019	0,069	Phase 1	N/A	N/A
24th	0,005	0,019	Phase 1	N/A	N/A
25th	0,024	0,086	Phase 1	N/A	N/A
26th	0,005	0,018	Phase 1	N/A	N/A
27th	0,011	0,041	Phase 1	N/A	N/A
28th	0,006	0,021	Phase 1	N/A	N/A
29th	0,017	0,061	Phase 1	N/A	N/A
30th	0,006	0,022	Phase 1	N/A	N/A
31th	0,017	0,060	Phase 1	N/A	N/A
32th	0,006	0,022	Phase 1	N/A	N/A
33th	0,009	0,032	Phase 1	N/A	N/A
34th	0,006	0,022	Phase 1	N/A	N/A
35th	0,014	0,048	Phase 1	N/A	N/A
36th	0,006	0,022	Phase 1	N/A	N/A
37th	0,015	0,055	Phase 1	N/A	N/A
38th	0,006	0,020	Phase 1	N/A	N/A
39th	0,008	0,028	Phase 1	N/A	N/A
40th	0,006	0,021	Phase 1	N/A	N/A
THD ₄₀	-	0,47	Phase 1	13	13
PWHD	-	0,001	Phase 1	22	22

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Power Quality. Harmonic current emission					
EUT		KACO Blueplanet 20.0			
Harmonic order n	Current Magnitude [A] at 100% rated output power	% of Fundamental	Phase	Harmonic current limit EN61000-3-12 [%]	
				1 phase	3 phase
1st	27,870	100,000	Phase 2	-	-
2nd	0,058	0,207	Phase 2	8	8
3rd	0,018	0,065	Phase 2	21,6	N/A
4th	0,012	0,042	Phase 2	4	4
5th	0,048	0,174	Phase 2	10,7	10,7
6th	0,008	0,029	Phase 2	2,67	2,67
7th	0,045	0,162	Phase 2	7,2	7,2
8th	0,008	0,029	Phase 2	2	2
9th	0,013	0,048	Phase 2	3,8	N/A
10th	0,007	0,027	Phase 2	1,6	1,6
11th	0,036	0,129	Phase 2	3,1	3,1
12th	0,007	0,025	Phase 2	1,33	1,33
13th	0,030	0,107	Phase 2	2	2
14th	0,007	0,024	Phase 2	N/A	N/A
15th	0,016	0,058	Phase 2	N/A	N/A
16th	0,006	0,023	Phase 2	N/A	N/A
17th	0,021	0,077	Phase 2	N/A	N/A
18th	0,006	0,023	Phase 2	N/A	N/A
19th	0,025	0,088	Phase 2	N/A	N/A
20th	0,006	0,021	Phase 2	N/A	N/A
21th	0,017	0,060	Phase 2	N/A	N/A
22th	0,006	0,020	Phase 2	N/A	N/A
23th	0,020	0,072	Phase 2	N/A	N/A
24th	0,006	0,021	Phase 2	N/A	N/A
25th	0,023	0,081	Phase 2	N/A	N/A
26th	0,005	0,019	Phase 2	N/A	N/A
27th	0,010	0,037	Phase 2	N/A	N/A
28th	0,005	0,020	Phase 2	N/A	N/A
29th	0,015	0,055	Phase 2	N/A	N/A
30th	0,005	0,020	Phase 2	N/A	N/A
31th	0,016	0,058	Phase 2	N/A	N/A
32th	0,005	0,020	Phase 2	N/A	N/A
33th	0,007	0,025	Phase 2	N/A	N/A
34th	0,005	0,020	Phase 2	N/A	N/A
35th	0,014	0,049	Phase 2	N/A	N/A
36th	0,005	0,019	Phase 2	N/A	N/A
37th	0,014	0,049	Phase 2	N/A	N/A
38th	0,005	0,019	Phase 2	N/A	N/A
39th	0,007	0,025	Phase 2	N/A	N/A
40th	0,005	0,018	Phase 2	N/A	N/A
THD ₄₀	-	0,45	Phase 2	13	13
PWHD	-	0,001	Phase 2	22	22

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Power Quality. Harmonic current emission					
EUT		KACO Blueplanet 20.0			
Harmonic order n	Current Magnitude [A] at 100% rated output power	% of Fundamental	Phase	Harmonic current limit EN61000-3-12 [%]	
				1 phase	3 phase
1st	27,854	100,000	Phase 3	-	-
2nd	0,031	0,111	Phase 3	8	8
3rd	0,025	0,089	Phase 3	21,6	N/A
4th	0,013	0,046	Phase 3	4	4
5th	0,044	0,157	Phase 3	10,7	10,7
6th	0,009	0,033	Phase 3	2,67	2,67
7th	0,045	0,162	Phase 3	7,2	7,2
8th	0,009	0,034	Phase 3	2	2
9th	0,015	0,054	Phase 3	3,8	N/A
10th	0,009	0,031	Phase 3	1,6	1,6
11th	0,028	0,102	Phase 3	3,1	3,1
12th	0,008	0,029	Phase 3	1,33	1,33
13th	0,027	0,097	Phase 3	2	2
14th	0,008	0,028	Phase 3	N/A	N/A
15th	0,015	0,053	Phase 3	N/A	N/A
16th	0,008	0,027	Phase 3	N/A	N/A
17th	0,019	0,069	Phase 3	N/A	N/A
18th	0,007	0,026	Phase 3	N/A	N/A
19th	0,023	0,083	Phase 3	N/A	N/A
20th	0,007	0,024	Phase 3	N/A	N/A
21th	0,013	0,046	Phase 3	N/A	N/A
22th	0,006	0,023	Phase 3	N/A	N/A
23th	0,018	0,065	Phase 3	N/A	N/A
24th	0,006	0,023	Phase 3	N/A	N/A
25th	0,022	0,078	Phase 3	N/A	N/A
26th	0,006	0,022	Phase 3	N/A	N/A
27th	0,010	0,035	Phase 3	N/A	N/A
28th	0,006	0,022	Phase 3	N/A	N/A
29th	0,015	0,053	Phase 3	N/A	N/A
30th	0,006	0,022	Phase 3	N/A	N/A
31th	0,015	0,055	Phase 3	N/A	N/A
32th	0,006	0,022	Phase 3	N/A	N/A
33th	0,008	0,029	Phase 3	N/A	N/A
34th	0,006	0,021	Phase 3	N/A	N/A
35th	0,012	0,042	Phase 3	N/A	N/A
36th	0,006	0,021	Phase 3	N/A	N/A
37th	0,013	0,046	Phase 3	N/A	N/A
38th	0,006	0,021	Phase 3	N/A	N/A
39th	0,007	0,026	Phase 3	N/A	N/A
40th	0,006	0,021	Phase 3	N/A	N/A
THD ₄₀	-	0,39	Phase 3	13	13
PWHD	-	0,001	Phase 3	22	22

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

Nr. 10TH0306

Voltage fluctuation and Flicker.					
	Maximum permissible flicker and voltage fluctuation as per EN 61000-3-11				
Value	Pst	Plt 2 hours	d(t) _{500ms}	dc	dmax
Limit	1,0	0,65	3,3%	3,3%	4%
Test value	0,079	0,079	3,03%	3,03%	0,30%

DC-Injection.				
Protection limit	Tested at four power levels, limit 0,5% of IAC _{nom} = 145 mA			
Output power	~20%	~50%	75%	~100%
Max. test value (phase L1) [mA]	38,30	33,30	37,61	32,98
Max. test value (phase L2) [mA]	57,70	57,40	54,04	47,20
Max. test value (phase L3) [mA]	13,74	10,16	14,67	8,71