



**BUREAU
VERITAS**

Potvrzení o nezávadnosti

Žadatel: KACO new energy GmbH
Carl-Zeiss-Straße 1
74172 Neckarsulm
Německo

Výrobek: Samostatná spínací stanice mezi síťově paralelním vlastním výrobním zařízením a veřejnou sítí nízkého napětí

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

Používání podle určení:

Samostatná spínací stanice s třífázovou kontrolou sítě dle DIN V VDE V 0126-1-1:2006-02, DIN V VDE V 0126-1-1/A1:2012-02 (s ČR odchylkami podle EN 50438:2013, ČSN EN 50438:2013, Annex A*) pro fotovoltaická zařízení s třífázovým paralelním napájením pomocí měniče do sítě veřejného napájení. Samostatná spínací stanice je integrační součástí výše uvedených beztransformátorových měničů s Tato slouží jako náhrada za spínací stanici s dělicí funkcí, která je kdykoli přístupná provozovateli rozvodné sítě (VNB).

Zkušební podklady:

EN 50438:2013, ČSN EN 50438:2013

Požadavky na paralelní připojení mikrogenerátorů s veřejnými distribučními sítěmi nízkého napětí

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

Samostatná spínací stanice mezi síťově paralelním vlastním výrobním zařízením a veřejnou sítí nízkého napětí

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

Samostatná spínací stanice mezi síťově paralelním vlastním výrobním zařízením a veřejnou sítí nízkého napětí, pozměňovací návrh 1

Reprezentativní zkušební vzorek výše jmenovaného výrobku odpovídá bezpečnostně technickým požadavkům platným v okamžiku vydání tohoto certifikátu, uvedených zkušebních podkladů pro používání podle určení.

Číslo zprávy: 10TH0306-EN50438_0

Číslo certifikátu: U16-0480

Datum: 2016-08-26

Institut pro certifikaci

Dieter Zitzmann



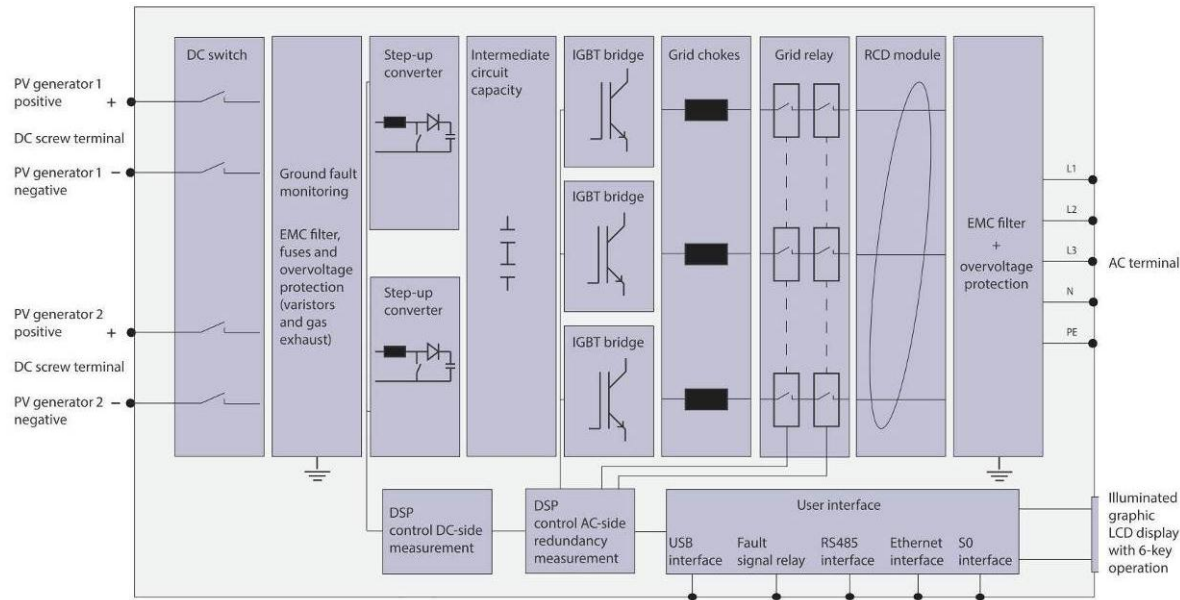
Deutsche
Akkreditierungsstelle
D-ZE-12024-01-00

Institut pro certifikaci Bureau Veritas Consumer Products Services Germany GmbH
Akreditovaným podle 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.

Appendix E Type Verification Test Report

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

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 | 187 |
| Under-voltage stage 1 | 195,5 | 0,2 | 195,5 | 0,2 | 196,4 | 186 |

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 | 190 |
| Under-voltage stage 1 | 195,5 | 0,2 | 195,5 | 0,2 | 197,0 | 190 |

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 | 183 |
| Under-voltage stage 1 | 195,5 | 0,2 | 195,5 | 0,2 | 197,1 | 183 |

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.

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

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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 13 | 33% of +5% Q Test 31 | 66% of +5% Q Test 21 | 100% of +5% P Test 14 |
| Trip time [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 |

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

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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 |
| 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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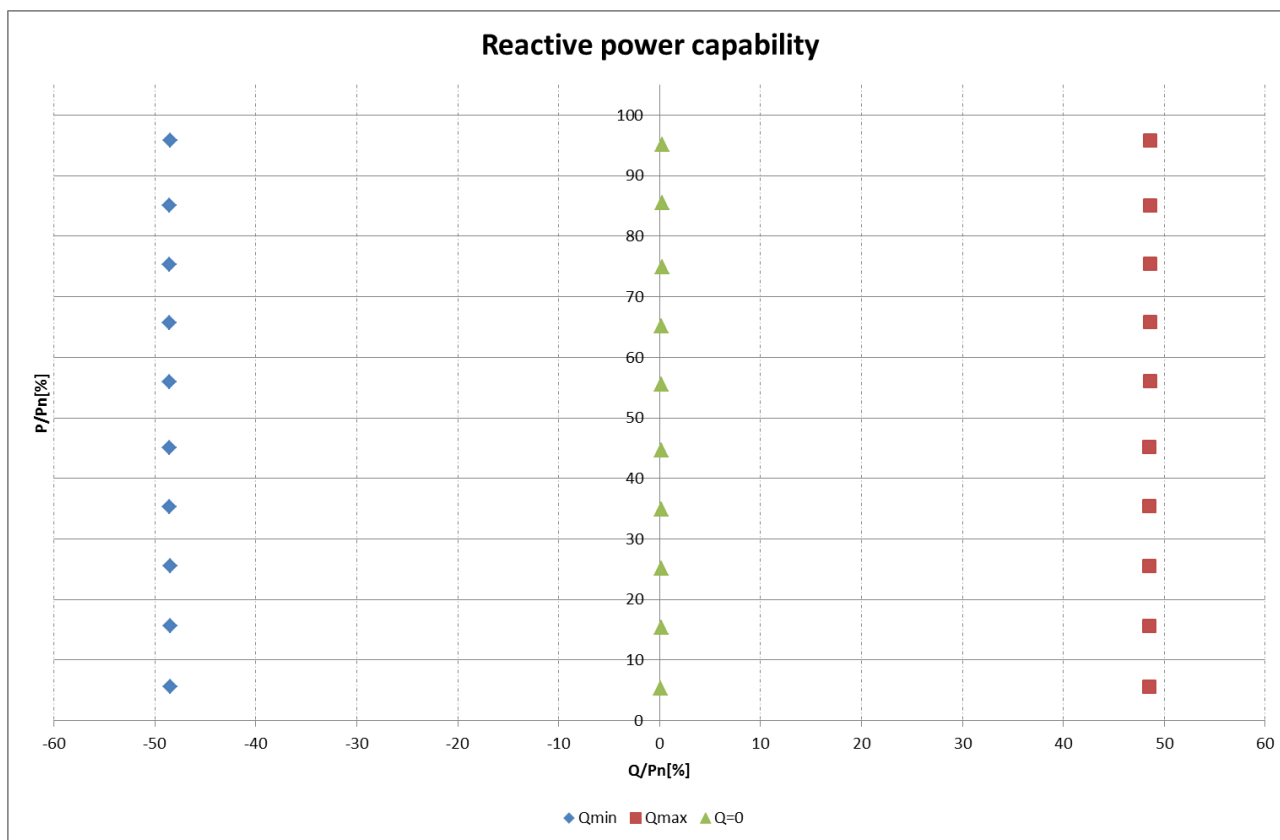
| Controllable reactive power | | | | |
|--|------------------|----------------------|----------------------|--------------|
| Blueplanet 20.0 | | | | |
| Inductive (supply reactive power) | | | | |
| Power-BIN | Active power [W] | Reactive power [Var] | Power factor (cos φ) | DC power [W] |
| 0% - 10% | 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 φ | Deviation compared to setpoint ΔQ / 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% |

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

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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 | >50,05 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 |

Appendix E Type Verification Test Report

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 |

Appendix E Type Verification Test Report

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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 |

Appendix E Type Verification Test Report

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 | 27,854 | 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 |