



**BUREAU
VERITAS**

Certificado de conformidade

Requerente: KACO new energy GmbH
Carl-Zeiss-Straße 1
74172 Neckarsulm
Alemanha

Produto: Microgerador em paralelo com redes de distribuição pública de baixa tensão

Modelo: KACO blueplanet 50.0 TL3 M1 WM OD IIGM
KACO blueplanet 50.0 TL3 M1 WM OD IIGB
KACO blueplanet 50.0 TL3 M1 WM OD IIGX
KACO blueplanet 50.0 TL3 M1 WM OD FRGX

Utilização de acordo com os regulamentos:

Dispositivo de desconexão automática com monitorização da rede trifásica para sistemas fotovoltaicos com um circuito paralelo trifásico através de um inversor na alimentação pela rede pública. O dispositivo de desconexão automática é parte integrante do inversor anteriormente mencionado.

Regras e normas aplicadas:

EN 50438:2013 com as definições de protecção de interface padrão para Portugal. O KACO blueplanet 50.0 TL3 M1 WM OD IIGM, KACO blueplanet 50.0 TL3 M1 WM OD IIGB e KACO blueplanet 50.0 TL3 M1 WM OD IIGX é dimensionado para uma corrente máxima >16 A por fase, mas todos os requisitos básicos da norma estão cumpridos.

Aquando da emissão deste certificado, o conceito de protecção de interface de um produto representativo anteriormente mencionado corresponde a especificações de segurança válidas para a utilização especificada, de acordo com os regulamentos. Os testes e certificação foram realizados de acordo com a norma ISO / IEC sistema 5 – Guia 67:2004.

Número de relatório: 15TH0250-EN50438_1
Número de certificado: U17-0468
Data de emissão: 2017-09-07 **Válido até:** 2022-09-06

Órgão de certificação



Holger Schaffer



Deutsche
Akkreditierungsstelle
D-ZE-12024-01-00

Órgão de certificação da Bureau Veritas Consumer Products Services Germany GmbH
Acreditado nos termos da norma DIN EN ISO/IEC 17065

Appendix E Type Verification Test Report
 Extract from test report according to EN 50438 Nr. 15TH0250

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 | KACO blueplanet 50.0 TL3 M1 WM OD IIGM KACO blueplanet 50.0 TL3 M1 WM OD IIGB KACO blueplanet 50.0 TL3 M1 WM OD IIGX KACO blueplanet 50.0 TL3 M1 WM OD FRGX |
| Maximum rated capacity | 50 kW |
| Rated voltage | 400 V _{AC} (P-P) / 230 V _{AC} (3/PEN), 42-68 Hz |
| Firmware version | PKT: V4.09; ARM: V5.08; CFG: V6.0572; DSP-AC: V4.09, DSP-DC: V4.02 |

* The tests were performed with Firmwareversion V4.09. Changes in the Firmwareversion on position V4.x have no effect on the required electrical properties.
 x = could be any number or sign

| | |
|----------------------------|---------------------------------|
| Measurement period: | 2017-09-04 to 2017-09-08 |
|----------------------------|---------------------------------|

Description of the structure of the power generation unit (Figure 1):

The input and output are protected by varistors to earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformer-less). The output is switched off redundant by the high power switching bridge and two relays in series. This assures that the opening of the output circuit will also operate in case of one error.

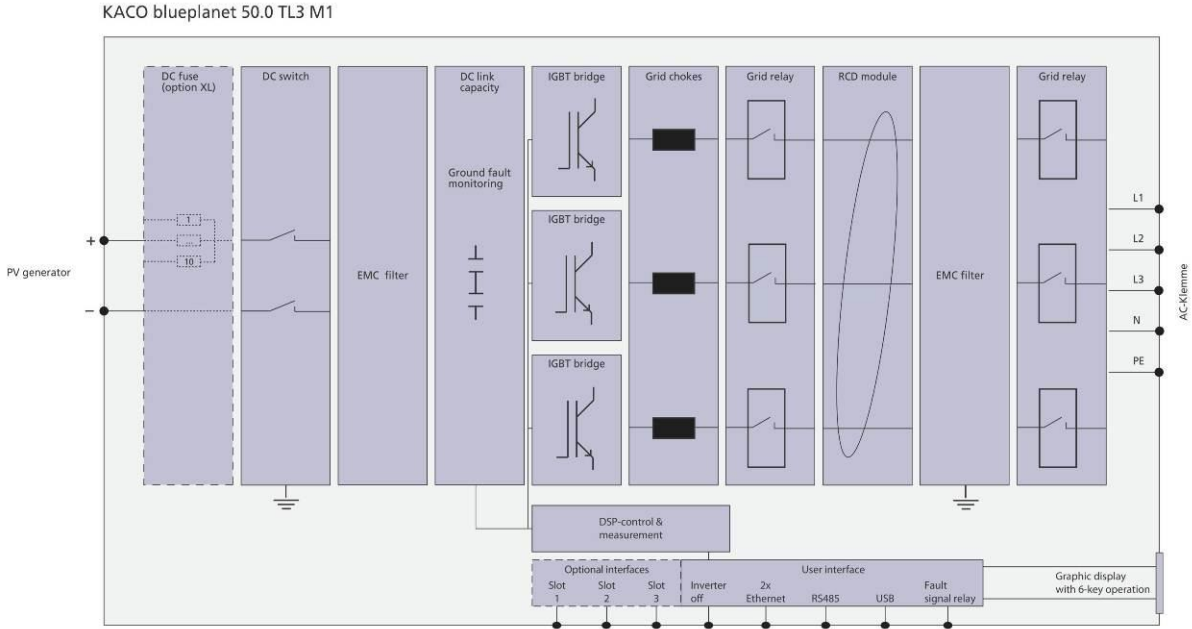


Figure 1 – Schematic structure of the power generation unit

The above stated micro-generators are tested according to the requirements in the EN 50438. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the EN 50438.

Appendix E Type Verification Test Report

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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 | 3,0 | 253,0 | 3,0 | 252,3 | 2,961 |
| Over-voltage stage 2 | 264,5 | 0,2 | 264,5 | 0,2 | 263,4 | 0,170 |
| Under-voltage stage 1 | 195,5 | 1,5 | 195,5 | 1,5 | 195,2 | 1,458 |
| 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 | 3,0 | 253,0 | 3,0 | 252,4 | 2,964 |
| Over-voltage stage 2 | 264,5 | 0,2 | 264,5 | 0,2 | 263,4 | 0,160 |
| Under-voltage stage 1 | 195,5 | 1,5 | 195,5 | 1,5 | 195,3 | 1,459 |
| 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 | 3,0 | 253,0 | 3,0 | 252,6 | 2,966 |
| Over-voltage stage 2 | 264,5 | 0,2 | 264,5 | 0,2 | 263,7 | 0,152 |
| Under-voltage stage 1 | 195,5 | 1,5 | 195,5 | 1,5 | 195,5 | 1,462 |
| Note. Minimum operation time according to default interface protection: Over-voltage stage 1 - Over-voltage stage 2 0,1s Under-voltage 1,2s | | | | | | |

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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 | 52,00 | 0,344 |
| Under-frequency | 47,50 | 0,5 | 47,50 | 0,5 | 47,50 | 0,375 |
| 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 [ms] | 211,6 | 210,3 | 601,6 | 235,5 | 229,9 | 363,4 |
| Indicate additional shut down time included in above results. (Integrated interface switch) | | | | Type of switching equipment 1: Finder 67.23 with 35ms Type of switching equipment 2: Finder 67.23 with 35ms | | |

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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 | 44,30 | 0,999 |
| 2 | 253,0 | 51,50 | 50,10 | 0,999 |

Active power at under-frequency

| 5-min mean value (each) | a) 50 ± 0,01 [Hz] | b) - 0,4 to - 0,5 [Hz] | c) - 2,4 to - 2,5 [Hz] |
|-------------------------|-------------------|------------------------|------------------------|
| Frequency [Hz]: | 49,99 | 49,59 | 47,59 |
| Active power [kW]: | 49,6 | 49,60 | 49,6 |
| ΔP/PM [%] per 1 Hz: | | | 0 |

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% P_n | | | | | | | |
| Frequency [Hz]: | 50,09 | 50,24 | 50,69 | 51,13 | 50,69 | 50,24 | 49,98 |
| PM [kW]: | N/A | 48,95 | 40,05 | 31,16 | 40,05 | 48,95 | N/A |
| PE60 [kW]: | 49,70 | 49,27 | 40,46 | 31,55 | 40,12 | 49,02 | 49,25 |
| ΔPE60/PM [%]: | N/A | 0,64 | 0,82 | 0,78 | 0,15 | 0,14 | N/A |
| 2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n | | | | | | | |
| Frequency [Hz]: | 50,09 | 50,24 | 50,69 | 51,13 | 50,69 | 50,24 | 49,98 |
| PM [kW]: | N/A | 24,74 | 20,24 | 15,75 | 20,24 | 24,74 | N/A |
| PE60 [kW]: | 25,12 | 24,98 | 20,41 | 15,93 | 20,25 | 24,74 | 27,05 |
| ΔPE60/PM [%]: | N/A | 0,48 | 0,33 | 0,36 | 0,03 | 0,00 | N/A |
| Limit ΔP/P1min: | + 10 % of P _M | | | | | | |

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| Reactive power | | | |
|-------------------------------|--------|-------|--------|
| Uncontrollable reactive power | | | |
| 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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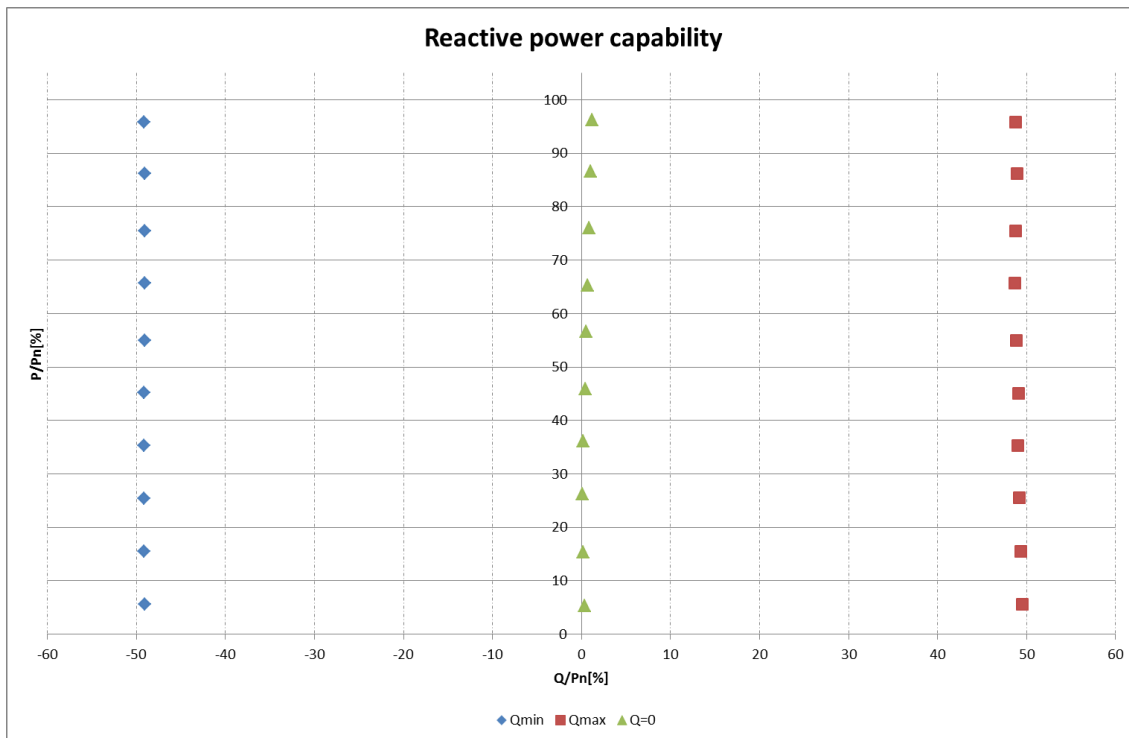
| Controllable reactive power | | | | |
|---|-------------------------|-----------------------------|-----------------------------|---------------------|
| Inductive (supply reactive power) | | | | |
| Power-BIN | Active power [W] | Reactive power [Var] | Power factor (cos φ) | DC power [W] |
| 0% - 10% | 2478,20 | 22021,98 | 0,11 | 2980,81 |
| 10% - 20% | 6925,19 | 21954,65 | 0,30 | 7429,73 |
| 20% - 30% | 11370,51 | 21888,04 | 0,46 | 11907,90 |
| 30% - 40% | 15735,82 | 21809,21 | 0,58 | 16336,77 |
| 40% - 50% | 20069,68 | 21829,44 | 0,68 | 20758,09 |
| 50% - 60% | 24454,56 | 21752,26 | 0,75 | 25229,66 |
| 60% - 70% | 29248,89 | 21670,05 | 0,80 | 30150,18 |
| 70% - 80% | 33602,72 | 21695,81 | 0,84 | 34627,38 |
| 80% - 90% | 38336,25 | 21773,32 | 0,87 | 39516,68 |
| 90% - 100% | 42632,39 | 21711,87 | 0,89 | 43955,73 |
| Capacitive (supply reactive power) | | | | |
| Power-BIN | Active power [W] | Reactive power [Var] | Power factor (cos φ) | DC power [W] |
| 0% - 10% | 2479,20 | -21812,24 | -0,11 | 2988,39 |
| 10% - 20% | 6910,81 | -21855,21 | -0,30 | 7433,00 |
| 20% - 30% | 11334,46 | -21868,20 | -0,46 | 11893,89 |
| 30% - 40% | 15728,76 | -21856,42 | -0,58 | 16341,43 |
| 40% - 50% | 20094,06 | -21866,24 | -0,68 | 20781,77 |
| 50% - 60% | 24437,80 | -21827,81 | -0,75 | 25220,90 |
| 60% - 70% | 29248,98 | -21844,27 | -0,80 | 30166,71 |
| 70% - 80% | 33570,48 | -21816,89 | -0,84 | 34619,02 |
| 80% - 90% | 38367,36 | -21838,97 | -0,87 | 39563,54 |
| 90% - 100% | 42629,34 | -21870,99 | -0,89 | 43980,60 |
| 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% | 2393,20 | 141,49 | 0,99 | 2487,44 |
| 10% - 20% | 6848,78 | 100,40 | 1,00 | 6989,40 |
| 20% - 30% | 11691,38 | 53,85 | 1,00 | 11917,69 |
| 30% - 40% | 16051,04 | 96,13 | 1,00 | 16367,01 |
| 40% - 50% | 20417,82 | 177,53 | 1,00 | 20846,33 |
| 50% - 60% | 25189,59 | 249,12 | 1,00 | 25732,69 |
| 60% - 70% | 29045,80 | 304,56 | 1,00 | 29704,15 |
| 70% - 80% | 33831,39 | 386,88 | 1,00 | 34646,49 |
| 80% - 90% | 38563,44 | 468,84 | 1,00 | 39558,70 |
| 90% - 100% | 42831,00 | 532,82 | 1,00 | 43983,72 |

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Diagram of inductive reactive power absorption



| Q adjustment | | | | |
|--------------|----------------------------------|---------------------------------|-------------------------|---|
| | Reactive power set point Q [Var] | Measured reactive power Q [Var] | Measured $\cos \varphi$ | Deviation compared to setpoint $\Delta Q / P_N$ [%] |
| - Qmin | -48.43 | -48,52% | 0,7174 | -0,09% |
| 0 | 0 | 0,47% | 1,0000 | 0,47% |
| + Qmax | +48,43 | 48,52% | 0,7182 | 0,09% |

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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] | 78 | 89 |
| 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] | 81 | 91 |
| 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] | 89 | 84 |
| 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] | 91 | 84 |
| 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 | 46,9 | 94,6 |
| Initial Value of aperiodic current | A | N/A | 100ms | 47,0 | 96,8 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 47,2 | 96,7 |
| Decaying (aperiodic) component of short circuit current* | i_{DC} | N/A | 500ms | 47,1 | 96,4 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to trip | 0,555 | In seconds |

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| Power Quality. Harmonic current emission | | | | | |
|--|--|--|---------|---|---------|
| EUT | | KACO blueplanet 50.0 TL3 M1 WM OD IIGM | | | |
| 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 | 72,813 | 100,000 | Phase 1 | - | - |
| 2nd | 0,317 | 0,436 | Phase 1 | 8 | 8 |
| 3rd | 0,186 | 0,255 | Phase 1 | 21,6 | N/A |
| 4th | 0,145 | 0,199 | Phase 1 | 4 | 4 |
| 5th | 0,362 | 0,496 | Phase 1 | 10,7 | 10,7 |
| 6th | 0,074 | 0,102 | Phase 1 | 2,67 | 2,67 |
| 7th | 0,265 | 0,364 | Phase 1 | 7,2 | 7,2 |
| 8th | 0,056 | 0,077 | Phase 1 | 2 | 2 |
| 9th | 0,058 | 0,079 | Phase 1 | 3,8 | N/A |
| 10th | 0,049 | 0,068 | Phase 1 | 1,6 | 1,6 |
| 11th | 0,203 | 0,279 | Phase 1 | 3,1 | 3,1 |
| 12th | 0,044 | 0,060 | Phase 1 | 1,33 | 1,33 |
| 13th | 0,167 | 0,229 | Phase 1 | 2 | 2 |
| 14th | 0,043 | 0,060 | Phase 1 | N/A | N/A |
| 15th | 0,046 | 0,064 | Phase 1 | N/A | N/A |
| 16th | 0,038 | 0,052 | Phase 1 | N/A | N/A |
| 17th | 0,152 | 0,209 | Phase 1 | N/A | N/A |
| 18th | 0,042 | 0,057 | Phase 1 | N/A | N/A |
| 19th | 0,154 | 0,212 | Phase 1 | N/A | N/A |
| 20th | 0,047 | 0,064 | Phase 1 | N/A | N/A |
| 21th | 0,052 | 0,071 | Phase 1 | N/A | N/A |
| 22th | 0,042 | 0,058 | Phase 1 | N/A | N/A |
| 23th | 0,154 | 0,212 | Phase 1 | N/A | N/A |
| 24th | 0,048 | 0,065 | Phase 1 | N/A | N/A |
| 25th | 0,167 | 0,229 | Phase 1 | N/A | N/A |
| 26th | 0,053 | 0,073 | Phase 1 | N/A | N/A |
| 27th | 0,063 | 0,086 | Phase 1 | N/A | N/A |
| 28th | 0,049 | 0,067 | Phase 1 | N/A | N/A |
| 29th | 0,160 | 0,219 | Phase 1 | N/A | N/A |
| 30th | 0,048 | 0,066 | Phase 1 | N/A | N/A |
| 31th | 0,146 | 0,200 | Phase 1 | N/A | N/A |
| 32th | 0,046 | 0,063 | Phase 1 | N/A | N/A |
| 33th | 0,055 | 0,076 | Phase 1 | N/A | N/A |
| 34th | 0,041 | 0,056 | Phase 1 | N/A | N/A |
| 35th | 0,105 | 0,144 | Phase 1 | N/A | N/A |
| 36th | 0,035 | 0,048 | Phase 1 | N/A | N/A |
| 37th | 0,095 | 0,131 | Phase 1 | N/A | N/A |
| 38th | 0,029 | 0,040 | Phase 1 | N/A | N/A |
| 39th | 0,038 | 0,052 | Phase 1 | N/A | N/A |
| 40th | 0,026 | 0,036 | Phase 1 | N/A | N/A |
| THD ₄₀ | - | 1,114 | Phase 1 | 13 | 13 |
| PWHD | - | 0,006 | Phase 1 | 22 | 22 |

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| Power Quality. Harmonic current emission | | | | | |
|--|--|--|---------|---|---------|
| EUT | | KACO blueplanet 50.0 TL3 M1 WM OD IIGM | | | |
| 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 | 72,834 | 100,000 | Phase 2 | - | - |
| 2nd | 0,255 | 0,350 | Phase 2 | 8 | 8 |
| 3rd | 0,099 | 0,136 | Phase 2 | 21,6 | N/A |
| 4th | 0,079 | 0,109 | Phase 2 | 4 | 4 |
| 5th | 0,369 | 0,506 | Phase 2 | 10,7 | 10,7 |
| 6th | 0,041 | 0,057 | Phase 2 | 2,67 | 2,67 |
| 7th | 0,241 | 0,330 | Phase 2 | 7,2 | 7,2 |
| 8th | 0,034 | 0,047 | Phase 2 | 2 | 2 |
| 9th | 0,050 | 0,069 | Phase 2 | 3,8 | N/A |
| 10th | 0,031 | 0,042 | Phase 2 | 1,6 | 1,6 |
| 11th | 0,198 | 0,272 | Phase 2 | 3,1 | 3,1 |
| 12th | 0,021 | 0,028 | Phase 2 | 1,33 | 1,33 |
| 13th | 0,173 | 0,238 | Phase 2 | 2 | 2 |
| 14th | 0,028 | 0,038 | Phase 2 | N/A | N/A |
| 15th | 0,033 | 0,046 | Phase 2 | N/A | N/A |
| 16th | 0,027 | 0,037 | Phase 2 | N/A | N/A |
| 17th | 0,161 | 0,222 | Phase 2 | N/A | N/A |
| 18th | 0,026 | 0,036 | Phase 2 | N/A | N/A |
| 19th | 0,159 | 0,219 | Phase 2 | N/A | N/A |
| 20th | 0,030 | 0,042 | Phase 2 | N/A | N/A |
| 21th | 0,036 | 0,050 | Phase 2 | N/A | N/A |
| 22th | 0,030 | 0,042 | Phase 2 | N/A | N/A |
| 23th | 0,168 | 0,231 | Phase 2 | N/A | N/A |
| 24th | 0,037 | 0,050 | Phase 2 | N/A | N/A |
| 25th | 0,169 | 0,232 | Phase 2 | N/A | N/A |
| 26th | 0,034 | 0,047 | Phase 2 | N/A | N/A |
| 27th | 0,043 | 0,058 | Phase 2 | N/A | N/A |
| 28th | 0,034 | 0,046 | Phase 2 | N/A | N/A |
| 29th | 0,185 | 0,254 | Phase 2 | N/A | N/A |
| 30th | 0,039 | 0,053 | Phase 2 | N/A | N/A |
| 31th | 0,157 | 0,216 | Phase 2 | N/A | N/A |
| 32th | 0,029 | 0,040 | Phase 2 | N/A | N/A |
| 33th | 0,040 | 0,055 | Phase 2 | N/A | N/A |
| 34th | 0,027 | 0,037 | Phase 2 | N/A | N/A |
| 35th | 0,127 | 0,174 | Phase 2 | N/A | N/A |
| 36th | 0,026 | 0,036 | Phase 2 | N/A | N/A |
| 37th | 0,101 | 0,139 | Phase 2 | N/A | N/A |
| 38th | 0,019 | 0,026 | Phase 2 | N/A | N/A |
| 39th | 0,028 | 0,039 | Phase 2 | N/A | N/A |
| 40th | 0,017 | 0,024 | Phase 2 | N/A | N/A |
| THD ₄₀ | - | 1,039 | Phase 2 | 13 | 13 |
| PWHD | - | 0,007 | Phase 2 | 22 | 22 |

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| Power Quality. Harmonic current emission | | | | | |
|--|--|--|---------|---|---------|
| EUT | | KACO blueplanet 50.0 TL3 M1 WM OD IIGM | | | |
| 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 | 72,773 | 100,000 | Phase 3 | - | - |
| 2nd | 0,258 | 0,354 | Phase 3 | 8 | 8 |
| 3rd | 0,129 | 0,177 | Phase 3 | 21,6 | N/A |
| 4th | 0,091 | 0,125 | Phase 3 | 4 | 4 |
| 5th | 0,374 | 0,514 | Phase 3 | 10,7 | 10,7 |
| 6th | 0,064 | 0,088 | Phase 3 | 2,67 | 2,67 |
| 7th | 0,271 | 0,372 | Phase 3 | 7,2 | 7,2 |
| 8th | 0,039 | 0,054 | Phase 3 | 2 | 2 |
| 9th | 0,049 | 0,067 | Phase 3 | 3,8 | N/A |
| 10th | 0,034 | 0,046 | Phase 3 | 1,6 | 1,6 |
| 11th | 0,188 | 0,258 | Phase 3 | 3,1 | 3,1 |
| 12th | 0,040 | 0,055 | Phase 3 | 1,33 | 1,33 |
| 13th | 0,187 | 0,258 | Phase 3 | 2 | 2 |
| 14th | 0,031 | 0,042 | Phase 3 | N/A | N/A |
| 15th | 0,034 | 0,047 | Phase 3 | N/A | N/A |
| 16th | 0,029 | 0,040 | Phase 3 | N/A | N/A |
| 17th | 0,148 | 0,204 | Phase 3 | N/A | N/A |
| 18th | 0,034 | 0,047 | Phase 3 | N/A | N/A |
| 19th | 0,173 | 0,237 | Phase 3 | N/A | N/A |
| 20th | 0,036 | 0,049 | Phase 3 | N/A | N/A |
| 21th | 0,037 | 0,051 | Phase 3 | N/A | N/A |
| 22th | 0,034 | 0,047 | Phase 3 | N/A | N/A |
| 23th | 0,149 | 0,205 | Phase 3 | N/A | N/A |
| 24th | 0,034 | 0,047 | Phase 3 | N/A | N/A |
| 25th | 0,172 | 0,237 | Phase 3 | N/A | N/A |
| 26th | 0,041 | 0,056 | Phase 3 | N/A | N/A |
| 27th | 0,045 | 0,062 | Phase 3 | N/A | N/A |
| 28th | 0,039 | 0,054 | Phase 3 | N/A | N/A |
| 29th | 0,161 | 0,222 | Phase 3 | N/A | N/A |
| 30th | 0,033 | 0,046 | Phase 3 | N/A | N/A |
| 31th | 0,148 | 0,204 | Phase 3 | N/A | N/A |
| 32th | 0,038 | 0,052 | Phase 3 | N/A | N/A |
| 33th | 0,043 | 0,058 | Phase 3 | N/A | N/A |
| 34th | 0,034 | 0,046 | Phase 3 | N/A | N/A |
| 35th | 0,114 | 0,156 | Phase 3 | N/A | N/A |
| 36th | 0,024 | 0,033 | Phase 3 | N/A | N/A |
| 37th | 0,089 | 0,122 | Phase 3 | N/A | N/A |
| 38th | 0,023 | 0,032 | Phase 3 | N/A | N/A |
| 39th | 0,029 | 0,039 | Phase 3 | N/A | N/A |
| 40th | 0,020 | 0,027 | Phase 3 | N/A | N/A |
| THD ₄₀ | - | 1,055 | Phase 3 | 13 | 13 |
| PWHD | - | 0,006 | Phase 3 | 22 | 22 |

Appendix E Type Verification Test Report

Extract from test report according to EN 50438

Nr. 15TH0250

| 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 | 0,086 | 0,086 | 0,0% | 3,3% | 0,33% |

| DC-Injection. | | | | |
|---------------------------------|--|-------|-------|-------|
| Protection limit | Tested at four power levels limit 0,5% of IAC _{nom} (362mA) | | | |
| Output power | ~20% | ~50% | 75% | ~100% |
| Max. test value (phase L1) [mA] | 48,33 | 54,83 | 48,79 | 25,72 |
| Max. test value (phase L2) [mA] | 11,83 | 18,13 | 20,72 | 29,41 |
| Max. test value (phase L3) [mA] | 66,91 | 71,52 | 59,57 | 29,74 |