Declaration of electrical behaviour

Manufacturer's name and address	**KACO new energy GmbH** Carl-Zeiss-Straße 1 74172 Neckarsulm, Germany
Product description	**Photovoltaic feed-in inverter**
Type designation	**KACO blueplanet 15.0 TL3 M2 WM OD IIG0** **KACO blueplanet 20.0 TL3 M2 WM OD IIG0**
Software Version	**Pkt 5.52 and above**

This is to confirm that the units listed above comply with the technical requirements of COMMISSION REGULATION 2016/631 with the national implementation of Poland for type A and type B:

Wymogi ogólnego stosowania wynikające z Rozporządzenia Komisji (UE) 2016/631 z dnia 14 kwietnia 2016 r. ustanawiającego kodeks sieci dotyczący wymogów w zakresie przyłączenia jednostek wytwórczych do sieci (NC RfG), 18-12-2018

General application requirements resulting from Commission Regulation (EU) 2016/631 of 14 April 2016 laying down the network code on requirements for connection of generation units to the grid (NC RfG), 18-12-2018

Confirmation of compliance is based on European Standard EN 50549-1:2019, EN 50549-2:2019 and EN 50438:2013.

Clause(s) / subclause(s) of EN 50549	EU 2016/631 Art.	Parameter	Typical value range	Inverter capability / default value	Poland Requirement	Fulfilled
4.4.2 Operating frequency range	13.1(a)	47,5 – 48,5 Hz Duration	n.a.	unlimited	30 min	yes
		48,5 – 49,0 Hz Duration	n.a.	unlimited	30 min	yes
		49,0 – 51,0 Hz Duration	n.a.	unlimited	unlimited	yes
		51,0 – 51,5 Hz Duration	n.a.	unlimited	n.a.	yes
		51, 5 – 52 Hz Duration	n.a.	unlimited	n.a.	yes
4.4.3 Minimal requirement for active power delivery at underfrequency	13.4 / 13.5	Reduction threshold	n.a.	n.a.	49Hz	yes
		Maximum reduction rate	n.a.	0 % P_M/Hz	2 % P_M/Hz	yes
4.5.2 Rate of change of frequency (ROCOF) immunity	13.1 b)	ROCOF withstand capability (defined with a sliding measurement window of 500 ms) non-synchronous generating technology:	not defined	3 Hz/s	2 Hz/s	yes
4.5.3 Under-voltage ride through (UVRT)	14.3	Maximum power resumption time	not defined	100ms	n.a	yes
4.5.3.2 Generating plant with non-synchronous	14.3	Voltage-Time-Diagram	see EN 50549 figure 6	Time [s] / U [p.u.]	Time [s] / U [p.u.]	
				0,0 / 0,00	0,0 / 0,00	yes

Clause(s) / subclause(s) of EN 50549	EU 2016/631 Art.	Parameter	Typical value range	Inverter capability / default value		Poland Requirement		Fulfilled
				1,0	0,00	1,0	0,00	yes
				2,0	0,50	2,0	0,50	yes
				30	0,50	30	0,50	yes
				Inf	0,80	Inf	0,80	yes
4.6.1 Power response to overfrequency	13.2	Threshold frequency f_1	50,2 Hz – 52 Hz	50,2 Hz		50,2 Hz		yes
		Droop	2 % – 12 %	5 %		5 %		yes
		Power reference	P_M | P_{max}	P_M		n.a		yes
		Intentional delay	0 – 2 s	0s		0s		yes
4.7.2.2 Reactive power capability	n.a.	Reactive power range overexcited	0 – 0,33	0 – 1		n.a.		yes
	n.a.	Reactive power range underexcited	0 – 0,33	0 – 1		n.a.		yes
4.7.2.3 Reactive power control modes	n.a.	available control mode	Q setp. Q(U) cos φ setp. cos φ (P)	Q setpoint		n.a.		yes
4.9.3 Requirements on voltage and frequency protection	n.a.	Undervoltage threshold stage 1	0,2 U_c – 1 U_c	0,85		0,85		yes
	n.a.	Undervoltage operate time stage 1	0,1 s – 100 s	0,5 s		0,5		yes
	n.a.	Overvoltage threshold stage 1	1,0 U_c – 1,2 U_c	1,15		1,15		yes
	n.a.	Overvoltage operate time stage 1	0,1 s – 100 s	0,2 s		0,2 s		yes
	n.a.	Overvoltage threshold 10 min mean protection	1,0 U_c – 1,15 U_c	1,10		1,10		yes
	n.a.	Underfrequency threshold stage 1	47,0 Hz– 50,0 Hz	47,5		47,5		yes
	n.a.	Underfrequency operate time stage 1	0,1 s – 100 s	0,5 s		0,5 s		yes
	n.a.	Overfrequency threshold stage 1	50,0 Hz – 52,0 Hz	52		52		yes
	n.a.	Overfrequency operate time stage 1	0,1 s – 100 s	0,5s		0,5s		yes
4.10 Automatic reconnection	13.7, 14.4	Lower frequency	47,0 Hz – 50,0 Hz	49,0 Hz		49,0 Hz		yes
		Upper frequency	50,0 Hz – 52,0 Hz	50,05 Hz		50,05 Hz		yes
		Lower voltage	50 % U_c – 100 % U_c	90 % U_c		n.a.		yes
		Upper voltage	100 % U_c – 120 % U_c	110 % U_c		n.a.		yes

Clause(s) / subclause(s) of EN 50549	EU 2016/631 Art.	Parameter	Typical value range	Inverter capability / default value	Poland Requirement	Fulfilled
		Observation time	10 s – 600 s	60 s	60s	yes
		Active power increase gradient	6 % – 3000 %/ min	10 % /min	10 % /min	yes
4.11.Reduction of active power on set point	13.6, 14.2	Remote operation Note: accessory needed	yes | no	yes	yes	yes
4.12 Remote information exchange	14.5 d) 15.2 b)	Remote information exchange required NOTE: If yes further definition is provided by the DSO	yes | no	yes	yes	yes

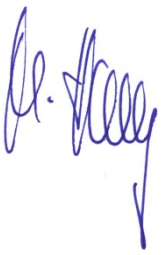
Note 1: compliance with requirements for type C and type D is also possible in combination with compliant plant control systems.

Note 2: the responsibility of correct configuration of the inverters and plant controller rests with the plant operator.

Note 3: the parameters mentioned here may differ from the parameters in the country setting Poland depending on the software version. It is the responsibility of your installer to check the software version and, if necessary, to install the current software.

Neckarsulm, 07/06/2019

KACO new energy GmbH



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