Certificate of compliance

Applicant:	**Guangzhou Felicity Solar Technology Co., Ltd.** **(Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China**
Product:	**Photovoltaic and battery inverter (Hybrid-Inverter)**
Model:	**IVGM3KLP1G2-24,** **IVGM3KLP1G2,** **IVGM3K6LP1G2** **IVGM4K6LP1G2,** **IVGM5KLP1G2,** **IVGM6KLP1G2**

The device is designed to work as a generation unit of the type: A

Inverter for single-phase parallel connection to the public grid. The network monitoring and disconnection device is an integral part of the above-mentioned model.

Applied rules and standards:

EN 50549-1:2019/A1:2023
Requirements for parallel connection of installations with distribution networks - Part 1: Connection to an LV distribution network - Production of installations up to and including Type B

4.4 Normal operating range
4.5 Immunity to disturbances
4.6 Active response to frequency deviation
4.7 Power response to voltage variations and voltage changes
4.8 EMC and power quality
4.9 Interface protection
4.10 Connection and starting to generate electrical power
4.11 Ceasing and reduction of active power on set point
4.13 Requirements regarding single fault tolerance of interface protection system and interface switch

EN 50549-10:2022
Requirements for generating plants to be connected in parallel with distribution networks - Part 10: Tests for conformity assessment of generating units

Compliance with the parameters in Annex C of the standard
(see appendix parameter table)

Commission Regulation (EU) 2016/631 of 14 April 2016
Establishing a network code on requirements for grid connection of generators (NC RFG).
Type approval for generation units to use in Type A plants.

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.

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Certification Program: **NSOP-0032-DEU-ZE-ES-V11**
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Certification body

Domenik Koll
Head of Energy Systems Germany

Accreditation

EUROPEAN RECOGNITION
DAkkS Deutsche Akkreditierungsstelle D-ZE-12024-01-00

Accredited certification body by Deutsche Akkreditierungsstelle GmbH (DAkkS) according to ISO/IEC 17065. The accreditation is valid only for the scope listed in the annex of the accreditation certificate D-ZE-12024-01-00. The Deutsche Akkreditierungsstelle GmbH (DAkkS) is signatory of the multilateral arrangements of EA, ILAC and IAF for mutual recognition.

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Type Approval and declaration of compliance with the requirements of EN 50549-1 and Commission Regulation (EU) 2016/631 of 14 April 2016				
Manufacturer	Guangzhou Felicity Solar Technology Co., Ltd. (Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China			
Product type	Photovoltaic and battery inverter (Hybrid-Inverter)			
Inverter model	IVGM3KLP1G2-24	IVGM3KLP1G2	IVGM3K6LP1G2	IVGM4K6LP1G2
Input (PV DC)				
MPP voltage range [V]	150-425	150-425	150-425	150-425
Max. input voltage [V]	500	500	500	500
Max. input current per MPP tracker [A]	18	18	18/18	18/18
Input (battery DC)				
DC voltage range [V]	20-30	40-60	40-60	40-60
Max. DC voltage [V]	30	60	60	60
Max. DC current per DC input [A]	140*1	70*1	90*1	115*1
AC connection				
Nominal AC voltage [V]	L/N/PE, 220 / 230 Va.c., 50/60 Hz	L/N/PE, 220 / 230 Va.c., 50/60 Hz	L/N/PE, 220 / 230 Va.c., 50/60 Hz	L/N/PE, 220 / 230 Va.c., 50/60 Hz
Nominal output current [A]	13,1	13,1	16	20
Max. output current [A]	14,4	14,4	16	22
Nominal output power inverter [W]	3000	3000	3680	4600
Nominal apparent output power inverter [VA]	3000	3000	3680	4600
On-grid battery mode				
P_{sn} (nominal discharge power) [W]	3000	3000	3680	4600
P_{cn} (nominal charging power) [W]	3000	3000	3680	4600
P_{smax} (max. discharge power) [W]	3000	3000	3680	4600
P_{cmax} (max. charging power) [W]	3000	3000	3680	4600
Type	Bidirectional	Bidirectional	Bidirectional	Bidirectional
Off-grid battery mode				
P_{sn} (nominal discharge power) [W]	3000	3000	3680	4600
P_{smax} (max. discharge power) [W]	3000	3000	3680	4600

Inverter model	IVGM5KLP1G2	IVGM6KLP1G2	--	--
Input (PV DC)				
MPP voltage range [V]	150-425	150-425	--	--
Max. input voltage [V]	500	500	--	--
Max. input current per MPP tracker [A]	18/18	18/18	--	--
Input (battery DC)				
DC voltage range [V]	40-60	40-60	--	--
Max. DC voltage [V]	60	60	--	--
Max. DC current per DC input [A]	120*1	135*1	--	--
AC connection				
Nominal AC voltage [V]	L/N/PE, 220 / 230 Va.c., 50/60 Hz	L/N/PE, 220 / 230 Va.c., 50/60 Hz	--	--
Nominal output current [A]	21,8	26,1	--	--
Max. output current [A]	24,0	28,7	--	--
Nominal output power inverter [W]	5000	6000	--	--
Nominal apparent output power inverter [VA]	5000	6000	--	--
On-grid battery mode				
P_{sn} (nominal discharge power) [W]	5000	6000	--	--
P_{cn} (nominal charging power) [W]	5000	6000	--	--
P_{smax} (max. discharge power) [W]	5000	6000	--	--
P_{cmax} (max. charging power) [W]	5000	6000	--	--
Type	Bidirectional	Bidirectional	--	--
Off-grid battery mode				
P_{sn} (nominal discharge power) [W]	5000	6000	--	--
P_{smax} (max. discharge power) [W]	5000	6000	--	--

Note

P_{sn} = rated discharge power, the maximum power that the system can deliver across the entire CUS range.

P_{cn} = rated charge power, the maximum power that the system can charge across the entire CUS range.

P_{smax} = maximum discharge power; the discharge power that the system must be able to deliver in the range from 10% to 90% of the CUS.

P_{cmax} = maximum charging power; the charging power that the system must guarantee in the range from 10% to 90% of the CUS.

CUS = usable capacity of the storage system; the amount of energy available at the connections of the storage system between the minimum and maximum state of charge.

Interface protection system and interface switch (Network and system protection "NS-protection")	
Type of protection	integrated NS-protection
Assigned to generation unit type	**IVGM3KLP1G2-24,** **IVGM3KLP1G2,** **IVGM3K6LP1G2** **IVGM4K6LP1G2,** **IVGM5KLP1G2,** **IVGM6KLP1G2**
Integrated interface switch	Type of switching equipment 1: Relay (Model CHFN-V-112H1A2F(50A)) Type of switching equipment 2: Relay (Model CHFN-V-112H1A2F(50A))
	Note: The output is switched off by the inverter bridge and two relay in series in each line and neutral.
Software	
Firmware version	100

Note

The settings of the product are password protected adjustable.

In case the generators are used with an external protection device, the protection settings of the inverters are to be adjusted according to the manufacturer's declaration.

The above stated generators are tested according to the requirements in the EN 50549-1 and the Commission Regulation (EU) 2016/631 of 14 April 2016. 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.

Type Approval and declaration of compliance with the requirements of EN 50549-1 and Commission Regulation (EU) 2016/631 of 14 April 2016

Parameter Table

Name of parameter set	EN50549-1
Specific technical requirement	EN50549-1&EN50549-10

Clause of EN 50549-1	Parameter	Remarks / additional information[b]	setting range	default settings used	
4.3.2 Interface switch	Single fault tolerance for interface switch		yes | no	yes	
4.4.2 Operating frequency range	47,0 – 47,5 Hz Duration		0 s – 20 s	0s	
	47,5 – 48,5 Hz Duration		30 – 90 min	30 min	
	48,5 – 49,0 Hz Duration		30 – 90 min	30 min	
	49,0 – 51,0 Hz Duration		not configurable	unlimited	
	51,0 – 51,5 Hz Duration		30 – 90 min	30 min	
	51, 5 – 52 Hz Duration		0 – 15 min	0 s	
4.4.3 Minimal requirement for active power delivery at under frequency	Reduction threshold		not configurable 49,0 Hz – 49,5 Hz	Electronic inverter, no power reduction take place 49,5 Hz	
	Maximum reduction rate		not configurable 2 – 10% P_M/Hz	≤ 2 % 10% P_M/Hz	
4.4.4 Continuous operating voltage range	Upper limit		not configurable 1,0 U_n – 2,0 U_n	1,15 U_n 1,10 U_n	
	Lower limit		not configurable 0,9 U_n – 1,0 U_n	0,85 U_n, 0,90 U_c	
4.5.2 Rate of change of frequency (ROCOF) immunity	ROCOF withstand capability (defined with a sliding measurement window of 500 ms) non-synchronous generating technology (inverter): synchronous generating technology:		not configurable 0 – 10 Hz/s yes no	2 Hz/s 1 Hz/s	
4.5.3.2 Generating plant with non-synchronous generating technology (FRT)	Voltage-Time-Diagram		see Figure 6 of EN 50549-1:2019	Time [s]	U [p.u.]
				0,0	0,2
				0,15	0,2
				1,5	0,85
				180	0,85
				180	0,9
4.5.4 Over-voltage ride through (OVRT)	Voltage-Time-Diagram			Time [s]	U [p.u.]
				0,0	1,25
				0,1	1,25
				0,1	1,20
				5,0	1,20
				5,0	1,15

				60	1,15
				60	1,10
4.5.5 Phase jump immunity	Phase jump immunity		not configurable	20°	
4.6.1 Power response to over frequency (LFSM-O)	Threshold frequency f_1		50,2 Hz – 52,0 Hz	50,2 Hz	
	Droop		2% – 12%	5%	
	Power reference		P_M | P_{max}	P_{max}	
	Intentional delay		0 s – 2 s	0 s	
	Deactivation threshold fstop		50,0 Hz – f_1	deactivated	
	Deactivation time t_{stop}		0 s – 600 s	-	
	Acceptance of staged disconnection		yes | no	yes	
4.6.2 Power response to under frequency (LFSM-U)	Threshold frequency f_1		49,8 Hz – 46,0 Hz	49,8 Hz	
	Droop		2 % – 12%	5%	
	Power reference		P_M | P_{max}	P_{max}	
	Intentional delay		0 s – 2 s	0 s	
4.7.2.2 Capabilities	Active factor range overexcited		0,90 – 1 / 48% P_d - 0 0,95 – 1 / 33% P_d - 0	0,80 – 1 / 66% P_d - 0	
	Active factor range underexcited		0,90 – 1 / 48% Pd - 0 0,95 – 1 / 33% Pd - 0	0,80 – 1 / 66% P_d - 0	
4.7.2.3 Control modes	Enabled control mode		Q setp. Q(U) Q(P) cos φ setp. cos φ (P)	activated deactivated deactivated deactivated deactivated	
4.7.2.3.2 Set point control modes	Q setpoint and excitation		0% – 48% P_D, 0% – 33% P_D	0	
	cos φ setpoint and excitation		1,0 – 0,9	1	
4.7.2.3.3 Voltage related control modes	Characteristic curve		Q(U) P(U)	deactivated deactivated	
	Time constant		3 s – 60 s	10 s	
	Min cos φ		0,0 – 1	0,8	
	Lock in power		0% – 20%	deactivated	
	Lock out power		0% – 20%	deactivated	
4.7.2.3.4 Power related control mode	Characteristic curve		cos φ (P)	deactivated	
4.7.4.2.2 Zero current mode for converter connected generating technology	Enabling		enable | disable	disable	
	Static voltage range overvoltage		100% U_n – 120% U_n	120% U_n	
	Static voltage range undervoltage		20% U_n – 100% U_n	50% U_n	

4.9.3 Requirements on voltage and frequency protection	Threshold for protection as dedicated device [in A or kW, kVA]		= 50,0 A 277Vac for CHFN-V-112H1A2F(50A) Note: Rated current of internal safety device!	Internal safety device
	Undervoltage threshold stage 1		0,2 U_n – 1 U_n	0,68 U_n
	Undervoltage operate time stage 1		0,1 s – 100 s	3,0 s
	Undervoltage threshold stage 2		0,2 U_n – 1 U_n	0,44 U_n
	Undervoltage operate time stage 2		0,1 s – 5 s	1,5 s
	Overvoltage threshold stage 1		1,0 U_n – 1,2 U_n	1,09 U_n
	Overvoltage operate time stage 1		0,1 s – 100 s	3,0 s
	Overvoltage threshold stage 2		1,0 U_n – 1,3 U_n	1,18 U_n
	Overvoltage operate time stage 2		0,1 s – 5 s	1,5 s
	Overvoltage threshold 10 min mean protection[a]		1,0 U_n – 1,15 U_n	1,10 U_n
	Overvoltage operate time 10 min mean protection[a]		0,04 s – 10,00 s	10 min (update every 3s)
	Underfrequency threshold stage 1		47,0 Hz – 50,0 Hz	49,0 Hz
	Underfrequency operate time stage 1		0,1 s – 100 s	3,0 s
	Underfrequency threshold stage 2		47,0 Hz – 50,0 Hz	48,0 Hz
	Underfrequency operate time stage 2		0,1 s – 5 s	1,5 s
	Overfrequency threshold stage 1		50,0 Hz – 52,0 Hz	50,5 Hz
	Overfrequency operate time stage 1		0,1 s – 100 s	3,0 s
	Overfrequency threshold stage 2		50,0 Hz – 52,0 Hz	51,5 Hz
	Overfrequency operate time stage 2		0,1 s – 5 s	1,5 s
	Loss of mains according EN 62116 (LoM)		0 s – 6000 s	ROCOF 2,0 Hz/s (0,5 s) active 2 s (5 s)
4.10.2 Automatic reconnection after tripping	Lower frequency		47,0 Hz – 50,0 Hz	49,5 Hz
	Upper frequency		50,0 Hz – 52,0 Hz	50,1 Hz
	Lower voltage		50% U_n – 100 % U_n	85% U_n, 90% U_c
	Upper voltage		100% U_n – 120% U_n	110% U_n
	Observation time		10 s – 600 s	60 s

	Active power increase gradient		6% – 3000% / min	10% / min
4.10.3 Starting to generate electrical power	Lower frequency		47,0 Hz – 50,0 Hz	49,5 Hz
	Upper frequency		50,0 Hz – 52,0 Hz	50,1 Hz
	Lower voltage		50% – 100% U_n	85% U_n, 90% U_c
	Upper voltage		100% – 120% U_n	110% U_n
	Observation time		10 s – 600 s	60 s
	Active power increase gradient		6% – 3000% / min	disabled
4.11.1 Ceasing active power	Remote operation of the logic interface		yes | no	WiFi module,4G module
4.11.2 Reduction of active power on set point	Remote operation NOTE: If yes further definition is provided by the DSO		yes | no	WIFI module,4G module
4.12 Remote information exchange	Remote information exchange required NOTE: If yes further definition is provided by the DSO		yes | no	N/A