

Certificate of compliance

Applicant: NingBo Deye Inverter Technology Co., Ltd.
No. 26 South YongJiang Road Daqi Beilun NingBo
China

Product: Hybrid Inverter

Model: SUN-5K-SG02LP1-EU-AM2, SUN-6K-SG02LP1-EU-AM2,
SUN-7.6K-SG02LP1-EU-AM2, SUN-8K-SG02LP1-EU-AM2,
SUN-10K-SG02LP1-EU-AM3, SUN-12K-SG02LP1-EU-AM3
SUN-7.6K-SG02LP1-EU-AM2-P, SUN-8K-SG02LP1-EU-AM2-P
SUN-10K-SG02LP1-EU-AM3-P, SUN-12K-SG02LP1-EU-AM3-P

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 body

Accreditation



Georg LORITZ
Lab Supervisor Energy Systems



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	NingBo Deye Inverter Technology Co., Ltd. No. 26 South YongJiang Road Daqi Beilun NingBo China			
Product type	Hybrid Inverter			
Static converter model	SUN-5K-SG02LP1-EU-AM2	SUN-6K-SG02LP1-EU-AM2	SUN-7.6K-SG02LP1-EU-AM2	SUN-8K-SG02LP1-EU-AM2
Input DC (photovoltaic)				
MPP voltage range [V]	150-425	150-425	150-425	150-425
Max. input voltage [V]	500	500	500	500
Max. input current per MPPT [A]	20+20	20+20	26+26	26+26
Input DC (battery)				
DC voltage range [V]	40-60	40-60	40-60	40-60
Max. DC voltage [V]	60	60	60	60
Max. DC current per DC input [A]	120	135	190	190
Output AC				
Rated AC voltage [V]	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz
Rated output current [A]	21,8	26,1	33,1	34,8
Max. output current [A]	24,0	28,7	36,4	38,3
Nom. converter output (P_{NINV}) [W]	5000	6000	7600	8000
Max. apparent power [VA]	5500	6600	8360	8800
Static converter model	SUN-10K-SG02LP1-EU-AM3	SUN-12K-SG02LP1-EU-AM3	--	--
Input DC (photovoltaic)				
MPP voltage range [V]	150-425	150-425	--	--
Max. input voltage [V]	500	500	--	--
Max. input current per MPPT [A]	26+26+26	26+26+26	--	--
Input DC (battery)				
DC voltage range [V]	40-60	40-60	--	--
Max. DC voltage [V]	60	60	--	--
Max. DC current per DC input [A]	220	250	--	--
Output AC				
Rated AC voltage [V]	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	--	--
Rated output current [A]	43,5	52,2	--	--
Max. output current [A]	47,9	57,4	--	--
Nom. converter output (P_{NINV}) [W]	10000	12000	--	--
Max. apparent power [VA]	11000	13200	--	--

Static converter model	SUN-7.6K-SG02LP1-EU-AM2-P	SUN-8K-SG02LP1-EU-AM2-P	SUN-10K-SG02LP1-EU-AM3-P	SUN-12K-SG02LP1-EU-AM3-P
Input DC (photovoltaic)				
MPP voltage range [V]	150-425	150-425	150-425	150-425
Max. input voltage [V]	500	500	500	500
Max. input current per MPPT [A]	32+32	32+32	32+32+32	32+32+32
Input DC (battery)				
DC voltage range [V]	40-60	40-60	40-60	40-60
Max. DC voltage [V]	60	60	60	60
Max. DC current per DC input [A]	190	190	220	250
Output AC				
Rated AC voltage [V]	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz
Rated output current [A]	33,1	34,8	43,5	52,2
Max. output current [A]	36,4	38,3	47,9	57,4
Nom. converter output (P _{NINV}) [W]	7600	8000	10000	12000
Max. apparent power [VA]	8360	8800	11000	13200
Interface protection system and interface switch (Network and system protection “NS-protection”)				
Type of protection	Integrated NS-protection			
Assigned to generation unit type	SUN-5K-SG02LP1-EU-AM2, SUN-6K-SG02LP1-EU-AM2, SUN-7.6K-SG02LP1-EU-AM2, SUN-8K-SG02LP1-EU-AM2, SUN-10K-SG02LP1-EU-AM3, SUN-12K-SG02LP1-EU-AM3, SUN-7.6K-SG02LP1-EU-AM2-P, SUN-8K-SG02LP1-EU-AM2-P, SUN-10K-SG02LP1-EU-AM3-P, SUN-12K-SG02LP1-EU-AM3-P			
Integrated interface switch	Type of switching equipment 1: Relay (Model CHAR-112A90EA) Type of switching equipment 2: Relay (Model ME101-1A-1-F)			
	Note: The output is switched off by the inverter bridge and two relays in series in each line and neutral.			
Firmware version	3386			
Note				
The settings of the generation unit are password protected adjustable.				
In case the above stated 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 50549-1:2019 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.				

Name of parameter set		EN50549-1&EN50549-10		
specific technical requirement (e.g. grid codes)		EN50549-10		
Clause(s) / subclause(s) of EN 50549-1:2019	Parameter ^a	Remarks/ additional information ^b	configurable value range	default value
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 – 52,0 Hz Duration		0 – 15 min	0 s
4.4.3 Minimal requirement for active power delivery at underfrequency	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	2 Hz/s
			yes no	

4.5.3.2 Under-voltage ride through (UVRT) Generating plant with non-synchronous generating technology (inverter)	Voltage-Time- Diagram		see Figure 6 of EN 50549-1:2019 and EN 50549-2:2019	Time [s]	U [p.u.]
				0,00	0,20
				0,15	0,20
				1,50	0,85
				180	0,85
				180	0,90
	Fast fault current		Rated value	SUN-5K-SG02LP1-EU-AM2: 21,8A SUN-6K-SG02LP1-EU-AM2: 26,1A SUN-7.6K-SG02LP1-EU-AM2: 33,1A SUN-8K-SG02LP1-EU-AM2: 34,8A SUN-10K-SG02LP1-EU-AM3: 43,5A SUN-12K-SG02LP1-EU-AM3: 52,2A SUN-7.6K-SG02LP1-EU-AM2-P: 33,1A SUN-8K-SG02LP1-EU-AM2-P: 34,8A SUN-10K-SG02LP1-EU-AM3-P: 43,5A SUN-12K-SG02LP1-EU-AM3-P: 52,2A (rated current)	
	Active power recovery after a short circuit		configurable	Start at 90% U_n	
	Fault recovery of active power (times calculated from the removal of the short circuit)		configurable	≤ 5 s	
	Value for recovered active power		configurable	≥ 90 %	
	Accuracy for recovery of active power		not configurable	≤ 10 %	
	Reactive power contribution has priority		yes no	Yes	

4.5.4 Over-voltage ride through (OVRT)	Voltage-Time- Diagram		not configurable see Figure 8 of	Time [s]	U [p.u.]
			EN 50549-1:2019	0,0	1,25
			and	0,1	1,25
			EN 50549-2:2019	0,1	1,20
				5,0	1,20
				5,0	1,15
				60,0	1,15
				60,0	1,10
	Active power recovery after a short circuit		configurable	Start at 90% U_n	
	Fault recovery of active power (times calculated from the removal of the short circuit)		configurable	≤ 5 s	
	Value for recovered active power		configurable	$\geq 90\%$	
	Accuracy for recovery of active power		not configurable	$\leq 10\%$	
4.6.1 Power response to overfrequency	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} , for synchronous generating technology and EESS	
	Intentional delay		0 s – 2 s	0 s	
	Deactivation threshold f_{stop}		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 underfrequency	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 voltage support by reactive power - Capabilities	Active factor / Reactive power (% P_d) range overexcited		0,90 – 1 / 48% P_d - 0 0,95 – 1 / 33% P_d - 0	0,95 – 1 / 33% P_d - 0	
	Active factor / Reactive power (% P_d) range underexcited		0,90 – 1 / 48% P_d - 0 0,95 – 1 / 33% P_d - 0	0,95 – 1 / 33% P_d - 0	
4.7.2.3 voltage support by reactive power - 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 voltage support by reactive power - Set point control modes	Q set point and excitation		0% – 48% P_D , 0% – 33% P_D	0
	$\cos \varphi$ set point and excitation		1,0 – 0,9	1
4.7.2.3.3 voltage support by reactive power - Voltage related control modes	Characteristic curve		$\cos \varphi (P)$ $Q(P)$	indicate default characteristic
	Time constant		3 s – 60 s	10 s
	Min $\cos \varphi$		0,0 – 1	0,9
	Lock-in power		0% – 20%	deactivated
	Lock-out power		0% – 20%	deactivated
4.7.2.3.4 voltage support by reactive power - Power related control mode	Characteristic curve		$Q(U)$ $P(U)$	$Q(U)$ (three-phase inverter) 0,00...-0,436 0,92...-0,436 0,94...0,0 1,06...0,0 1,08...0,436 1,20...0,436 $P(U)$ deactivated
4.7.4.2.2 Zero current mode for converter connected generating technology / Generating Plant with non-synchronous generator	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]		100 A Note: Rated current of internal safety device!	Internal safety device
	Undervoltage threshold stage 1		0,2 U_n – 1 U_n	0,85 U_n
	Undervoltage operate time stage 1		0,1 s – 100 s	1,2 – 1,5 s
	Undervoltage threshold stage 2		0,2 U_n – 1 U_n	N/A
	Undervoltage operate time stage 2		0,1 s – 5 s	N/A
	Overvoltage threshold stage 1		1,0 U_n – 1,2 U_n	1,15 U_n
	Overvoltage operate time stage 1		0,1 s – 100 s	0,1 – 0,2 s
	Overvoltage threshold stage 2		1,0 U_n – 1,3 U_n	1,25 U_n (N/A)
	Overvoltage operate time stage 2		0,1 s – 5 s	0,1 s (N/A)
	Overvoltage threshold 10 min mean protection		1,0 U_n – 1,15 U_n	1,10 U_n
	Overvoltage operate time 10 min mean protection		0,04 s – 10,00 s	10 min (update every 3s)
	Underfrequency threshold stage 1		47,0 Hz – 50,0 Hz	47,5 Hz

	Underfrequency operate time stage 1		0,1 s – 100 s	0,3 s – 0,5 s
	Underfrequency threshold stage 2		47,0 Hz – 50,0 Hz	N/A
	Underfrequency operate time stage 2		0,1 s – 5 s	N/A
	Overfrequency threshold stage 1		50,0 Hz – 52,0 Hz	52,0 Hz
	Overfrequency operate time stage 1		0,1 s – 100 s	0,3 s – 0,5 s
	Overfrequency threshold stage 2		50,0 Hz – 52,0 Hz	N/A
	Overfrequency operate time stage 2		0,1 s – 5,0 s	N/A
	Loss of mains according EN 62116 (LoM)		0 s – 6000 s	ROCOF 2,5 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	50,2 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	11% U _n
	Observation time		10 s – 600 s	60 s
	Active power increase gradient		6% – 3000% / min	disabled
4.11.1 Ceasing active power	activation option		RS485, WIFI, Local	
4.11.2 Reduction of active power on set point	activation option		RS485, WIFI, Local	
4.12 Remote information exchange	available communication standards			
a If additional parameters have been evaluated during the test, these shall be added as additional lines in the table.				
b This column should be used for manufacturer specific parameter descriptions.				