

Certificate of compliance

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

Product: Photovoltaic and battery inverter (Hybrid-Inverter)

Model: SUN-3.6K-SG05LP1-EU-AM2-P, SUN-5K-SG05LP1-EU-AM2-P,
SUN-6K-SG05LP1-EU-AM2-P, SUN-7K-SG05LP1-EU-AM2-P,
SUN-7.6K-SG05LP1-EU-AM2-P, SUN-8K-SG05LP1-EU-AM2-P,
SUN-10K-SG05LP1-EU-AM2-P, SUN-3.6K-SG05LP1-EU,
SUN-5K-SG05LP1-EU, SUN-6K-SG05LP1-EU, SUN-7K-SG05LP1-EU,
SUN-7.6K-SG05LP1-EU, SUN-8K-SG05LP1-EU, SUN-10K-SG05LP1-EU,
AI-W5.1-3.6P1-EU-B, AI-W5.1-5P1-EU-B, AI-W5.1-6P1-EU-B,
AI-W5.1-7P1-EU-B, AI-W5.1-7.6P1-EU-B, AI-W5.1-8P1-EU-B, AI-W5.1-10P1-EU-B

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-V10

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Certification body

Accreditation



Domenik Koll
Head of Energy Systems Germany



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	Photovoltaic and battery inverter (Hybrid-Inverter)			
Static converter model	SUN-3.6K-SG05LP1-EU	SUN-5K-SG05LP1-EU	SUN-6K-SG05LP1-EU	SUN-7K-SG05LP1-EU
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]	13+13	13+13	13+13	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]	90	120	135	175
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]	15,7	21,7	26,1	30,5
Max. output current [A]	17,2	23,9	28,7	33,5
Nom. converter output (P_{NINV}) [kW]	3,60	5,00	6,00	7,00
Max. apparent power [kVA]	3,96	5,50	6,60	7,70
Static converter model	SUN-7.6K-SG05LP1-EU	SUN-8K-SG05LP1-EU	SUN-10K-SG05LP1-EU	-
Input DC (photovoltaic)				
MPP voltage range [V]	150-425	150-425	150-425	-
Max. input voltage [V]	500	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	40-60	-
Max. DC voltage [V]	60	60	60	-
Max. DC current per DC input [A]	190	190	210	-
Output AC				
Rated AC voltage [V]	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	-
Rated output current [A]	33,0	34,8	43,5	-
Max. output current [A]	36,3	38,3	47,9	-
Nom. converter output (P_{NINV}) [kW]	7,60	8,00	10,00	-
Max. apparent power [kVA]	8,36	8,80	11,00	-

Static converter model	SUN-3.6K-SG05LP1-EU-AM2-P	SUN-5K-SG05LP1-EU-AM2-P	SUN-6K-SG05LP1-EU-AM2-P	SUN-7K-SG05LP1-EU-AM2-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]	18+18	18+18	18+18	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]	90	120	135	175
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]	15,7	21,7	26,1	30,5
Max. output current [A]	17,2	23,9	28,7	33,5
Nom. converter output (P _{NINV}) [kW]	3,60	5,00	6,00	7,00
Max. apparent power [kVA]	3,96	5,50	6,60	7,70
Static converter model	SUN-7.6K-SG05LP1-EU-AM2-P	SUN-8K-SG05LP1-EU-AM2-P	SUN-10K-SG05LP1-EU-AM2-P	-
Input DC (photovoltaic)				
MPP voltage range [V]	150-425	150-425	150-425	-
Max. input voltage [V]	500	500	500	-
Max. input current per MPPT [A]	32+32	32+32	32+32	-
Input DC (battery)				
DC voltage range [V]	40-60	40-60	40-60	-
Max. DC voltage [V]	60	60	60	-
Max. DC current per DC input [A]	190	190	210	-
Output AC				
Rated AC voltage [V]	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	-
Rated output current [A]	33,0	34,8	43,5	-
Max. output current [A]	36,3	38,3	47,9	-
Nom. converter output (P _{NINV}) [kW]	7,60	8,00	10,00	-
Max. apparent power [kVA]	8,36	8,80	11,00	-

Static converter model	AI-W5.1-3.6P1-EU-B	AI-W5.1-5P1-EU-B	AI-W5.1-6P1-EU-B	AI-W5.1-7P1-EU-B
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]	18+18	18+18	18+18	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]	90	120	135	175
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]	15,7	21,7	26,1	30,5
Max. output current [A]	17,2	23,9	28,7	33,5
Nom. converter output (P_{NINV}) [kW]	3,6	5,00	6,00	7,00
Max. apparent power [kVA]	3,96	5,50	6,60	7,70
Static converter model	AI-W5.1-7.6P1-EU-B	AI-W5.1-8P1-EU-B	AI-W5.1-10P1-EU-B	-
Input DC (photovoltaic)				
MPP voltage range [V]	150-425	150-425	150-425	-
Max. input voltage [V]	500	500	500	-
Max. input current per MPPT [A]	32+32	32+32	32+32	-
Input DC (battery)				
DC voltage range [V]	40-60	40-60	40-60	-
Max. DC voltage [V]	60	60	60	-
Max. DC current per DC input [A]	190	190	210	-
Output AC				
Rated AC voltage [V]	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	L/N/PE, 230V, 50Hz	-
Rated output current [A]	33,0	34,8	43,5	-
Max. output current [A]	36,3	38,3	47,9	-
Nom. converter output (P_{NINV}) [kW]	7,60	8,00	10,00	-
Max. apparent power [kVA]	8,36	8,80	11,00	-

Interface protection system and interface switch (Network and system protection "NS-protection")	
Type of protection	integrated NS-protection
Assigned to generation unit type	SUN-3.6K-SG05LP1-EU-AM2-P, SUN-5K-SG05LP1-EU-AM2-P, SUN-6K-SG05LP1-EU-AM2-P, SUN-7K-SG05LP1-EU-AM2-P, SUN-7.6K-SG05LP1-EU-AM2-P, SUN-8K-SG05LP1-EU-AM2-P, SUN-10K-SG05LP1-EU-AM2-P, SUN-3.6K-SG05LP1-EU, SUN-5K-SG05LP1-EU, SUN-6K-SG05LP1-EU, SUN-7K-SG05LP1-EU, SUN-7.6K-SG05LP1-EU, SUN-8K-SG05LP1-EU, SUN-10K-SG05LP1-EU, AI-W5.1-3.6P1-EU-B, AI-W5.1-5P1-EU-B, AI-W5.1-6P1-EU-B, AI-W5.1-7P1-EU-B, AI-W5.1-7.6P1-EU-B, AI-W5.1-8P1-EU-B, AI-W5.1-10P1-EU-B
Integrated interface switch	Type of switching equipment 1: Relay (Model ME109-S-1A-JF) Type of switching equipment 2: Relay (Model ME109-S-1A-JF) These relays are used by the following models: SUN-3.6K-SG05LP1-EU-AM2-P, SUN-5K-SG05LP1-EU-AM2-P, SUN-6K-SG05LP1-EU-AM2-P, SUN-3.6K-SG05LP1-EU, SUN-5K-SG05LP1-EU, SUN-6K-SG05LP1-EU, AI-W5.1-3.6P1-EU-B, AI-W5.1-5P1-EU-B, AI-W5.1-6P1-EU-B)
	Type of switching equipment 1: Relay (Model ME121-S-1A-F) Type of switching equipment 2: Relay (Model ME121-S-1A-F) These relays are used by the following models: SUN-7K-SG05LP1-EU-AM2-P, SUN-7.6K-SG05LP1-EU-AM2-P, SUN-8K-SG05LP1-EU-AM2-P, SUN-10K-SG05LP1-EU-AM2-P, SUN-7K-SG05LP1-EU, SUN-7.6K-SG05LP1-EU, SUN-8K-SG05LP1-EU, SUN-10K-SG05LP1-EU, AI-W5.1-7P1-EU-B, AI-W5.1-7.6P1-EU-B, AI-W5.1-8P1-EU-B, AI-W5.1-10P1-EU-B)
	Note: The output is switched off by the inverter bridge and two relay in series in each line and neutral.
Firmware version	B388
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

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	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-3.6K-SG05LP1-EU-AM2-P:15,7A SUN-5K-SG05LP1-EU-AM2-P:21,7A SUN-6K-SG05LP1-EU-AM2-P:26,1A SUN-7K-SG05LP1-EU-AM2-P:30,5A SUN-7.6K-SG05LP1-EU-AM2-P:33,0A SUN-8K-SG05LP1-EU-AM2-P:34,8A SUN-10K-SG05LP1-EU-AM2-P:43,5A SUN-3.6K-SG05LP1-EU:15,7A SUN-5K-SG05LP1-EU:21,7A SUN-6K-SG05LP1-EU:26,1A SUN-7K-SG05LP1-EU:30,5A SUN-7.6K-SG05LP1-EU:33,0A SUN-8K-SG05LP1-EU:34,8A SUN-10K-SG05LP1-EU:43,5 A AI-W5.1-3.6P1-EU-B:15,7A AI-W5.1-5P1-EU-B:21,7A AI-W5.1-6P1-EU-B:26,1A AI-W5.1-7P1-EU-B:30,5A AI-W5.1-7.6P1-EU-B:33,0 A AI-W5.1-8P1-EU-B:34,8 A AI-W5.1-10P1-EU-B:43,5 A (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	

4.5.4 Over-voltage ride through (OVRT)	Value for recovered active power		configurable	$\geq 90 \%$	
	Accuracy for recovery of active power		not configurable	$\leq 10 \%$	
	Reactive power contribution has priority		yes no	Yes	
	Voltage-Time- Diagram		not configurable see Figure 8 of EN 50549-1:2019	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
				60,0	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	$\leq 5 \text{ s}$	
	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 f1		50,2 Hz – 52,0 Hz	50,2 Hz
	Droop		2% – 12%	5%
	Power reference		$P_M P_{max}$	P_M for other nonsynchronous Generating technology
	Intentional delay		0 s – 2 s	0 s
	Deactivation threshold fstop		50,0 Hz – f1	deactivated
	Deactivation time tstop		0 s – 600 s	-
	Acceptance of staged disconnection		yes no	yes
4.6.2 Power response to underfrequency	Threshold frequency f1		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 (%Pd) range overexcited		0,90 – 1 / 48% Pd - 0 0,95 – 1 / 33% Pd - 0	0,95 – 1 / 33% Pd - 0
	Active factor / Reactive power (%Pd) range underexcited		0,90 – 1 / 48% Pd - 0 0,95 – 1 / 33% Pd - 0	0,95 – 1 / 33% Pd - 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% PD, 0% – 33% PD	0
	cos φ 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 φ (P) Q(P)	indicate default characteristic
	Time constant		3 s – 60 s	10 s
	Min cos φ		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 /	Enabling		enable disable	disable
	Static voltage range overvoltage		100% Un – 120% Un	120% Un

Generating Plant with non-synchronous generator	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]		ME109-S-1A-JF: 50A ME121-S-1A-F: 66A 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	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	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		N/A	
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.				