

Compliance Document

No. D 104339 0045 Rev. 00

Holder of Certificate: **Ningbo Sunways Technologies Co.,Ltd.**

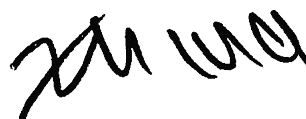
No. 1, Second Road
Green Industrial Zone
Chongshou Town
315334 Cixi, Ningbo, Zhejiang
PEOPLE'S REPUBLIC OF CHINA

Product: **Converter**
HYBRID INVERTER

This Compliance document confirms the compliance with the listed standards on a voluntary basis. It refers only to the sample submitted for testing and certification and does not certify the quality or safety of the serial products. For details see: www.tuvsud.com/ps-cert

Test report no.: 704092001224-00

Date, 2021-04-22



(Zhengdong Ma)

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Model(s): **STH-4KTL-HT, STH-5KTL-HT, STH-6KTL-HT,
STH-8KTL-HT, STH-10KTL-HT, STH-12KTL-HT.**

Parameters:

Model Name	STH-4KTL-HT	STH-5KTL-HT	STH-6KTL-HT
PV Input Parameters			
Max. Input Voltage	1000 Vd.c.		
MPPT Voltage Range	150-850 Vd.c.	200-850 Vd.c.	
Max. Input Current	13/13 Ad.c.		
Isc PV	18/18 Ad.c.		
Battery Input Parameters			
Battery Type	Li-Ion		
Battery Voltage Range	180-750 Vd.c.		
Max. Charge Current	25 Ad.c.		
Max. Discharge Current	25 Ad.c.		
A.C. Output Parameters			
Output Rated Voltage	3/N/PE~, 230/400 Va.c.		
Output Rated Frequency	50 Hz		
Output Rated Power	4000 W	5000 W	6000 W
Output Rated Apparent Power	4000 VA	5000 VA	6000 VA
Output Max. Apparent Power	4400 VA	5500 VA	6600 VA
Output Rated Current	5,8 Aa.c.	7,3 Aa.c.	8,7 Aa.c.
Output Max. Current	6,7 Aa.c.	8,3 Aa.c.	10 Aa.c.
Power factor	0.8 leading...0.8 lagging		
Back-Up Output Parameters			
Output Rated Voltage	3/N/PE~, 230/400 Va.c.		
Output Rated Frequency	50 Hz		
Output Rated Power	4000 W	5000 W	6000 W
Output Rated Apparent Power	4000 VA	5000 VA	6000 VA
Output Max. Apparent Power	4400 VA	5500 VA	6600 VA
A.C. Input Parameters			
Input Rated Voltage	3/N/PE~, 230/400 Va.c.		
Input Rated Frequency	50 Hz		
Input Max. Current	11,6 Aa.c.	14,5 Aa.c.	17,4 Aa.c.
Input Max. Apparent Power	8000 VA	10000 VA	12000 VA
Others			
Protection class	I		
Ingress protection	IP65		
Overvoltage category	II(PV), III(MAINS)		
Operating temperature range	-30°C ... +60°C		
Operating altitude	3000m		
Inverter topology	Non-isolated		

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Model Name	STH-8KTL-HT	STH-10KTL-HT	STH-12KTL-HT
PV Input Parameters			
Max. Input Voltage	1000 Vd.c.		
MPPT Voltage Range	200-850 Vd.c.		
Max. Input Current	13/13 Ad.c.		
Isc PV	18/18 Ad.c.		
Battery Input Parameters			
Battery Type	Li-Ion		
Battery Voltage Range	180-750 Vd.c.		
Max. Charge Current	25 Ad.c.		
Max. Discharge Current	25 Ad.c.		
A.C. Output Parameters			
Output Rated Voltage	3/N/PE~, 230/400 Va.c.		
Output Rated Frequency	50 Hz		
Output Rated Power	8000 W	10000 W	12000 W
Output Rated Apparent Power	8000 VA	10000 VA	12000 VA
Output Max. Apparent Power	8800 VA	11000 VA	13200 VA
Output Rated Current	11,6 Aa.c.	14,5 Aa.c.	17,4 Aa.c.
Output Max. Current	13,3 Aa.c.	16,5 Aa.c.	20 Aa.c.
Power factor	0.8 leading...0.8 lagging		
Back-Up Output Parameters			
Output Rated Voltage	3/N/PE~, 230/400 Va.c.		
Output Rated Frequency	50 Hz		
Output Rated Power	8000 W	10000 W	12000 W
Output Rated Apparent Power	8000 VA	10000 VA	12000 VA
Output Max. Apparent Power	8800 VA	11000 VA	13200 VA
A.C. Input Parameters			
Input Rated Voltage	3/N/PE~, 230/400 Va.c.		
Input Rated Frequency	50 Hz		
Input Max. Current	23,2 Aa.c.	23,9 Aa.c.	23,9 Aa.c.
Input Max. Apparent Power	16000 VA	16500 VA	16500 VA
Others			
Protection class	I		
Ingress protection	IP65		
Overvoltage category	II(PV), III(MAINS)		
Operating temperature range	-30°C ... +60°C		
Operating altitude	3000m		
Inverter topology	Non-isolated		

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E.4 Unit certificate

Unit certificate	No. 70.409.20.012.24-00	
Manufacturer	Ningbo Sunways Technologies Co., Ltd. No. 1, Second Road, Green Industrial Zone, Chongshou Town, 315334 Cixi, Ningbo, Zhejiang, PEOPLE'S REPUBLIC OF CHINA	
Power generation unit type	STH-4KTL-HT, STH-5KTL-HT, STH-6KTL-HT, STH-8KTL-HT, STH-10KTL-HT, STH-12KTL-HT Remark: certified on representative model STH-12KTL-HT of family design products, results of the measurement of STH-12KTL-HT can be transferred to the other models based on transferability rule of measurements in DIN VDE V 0124-100 (VDE V 0124-100):2020.	
<input checked="" type="checkbox"/> Inverter	<input type="checkbox"/> Asynchronous generator	<input type="checkbox"/> Synchronous generator
<input type="checkbox"/> Stirling generator	<input type="checkbox"/> Fuel cell	<input type="checkbox"/> others
Assessment values	Max. active power $P_{E_{max}}$	13,3 kW
	Max. apparent power $S_{E_{max}}$	13,5 kVA
	Rated voltage	3/N/PE~, 230/400 Va.c.
Rated values	Rated current (AC) I_r	17,4 A
Rated values	Max. current (AC) I_{max}	20 A
Rated values	Initial short-circuit current I_k "	20 A
Network connection rules	VDE-AR-N 4105 "Power generation systems connected to the low-voltage network" Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Test requirement	DIN VDE V 0124-100 (VDE V 0124-100) "Network integration of power generation system – Low voltage" Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network	
The above mentioned power generation unit meets the requirements of VDE-AR-N 4105.		

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E.5 Test report "Network interactions " for generating units with an input current > 75 A

Extract from test report for unit certificate "Determination of electrical properties"		No. 70.409.20.012.24-00
Generation unit manufacturer:	Ningbo Sunways Technologies Co., Ltd. No. 1, Second Road, Green Industrial Zone, Chongshou Town, 315334 Cixi, Ningbo, Zhejiang, PEOPLE'S REPUBLIC OF CHINA	
Manufacturer indications:	Type of system	HYBRID INVERTER
	Max. active power $P_{E_{max}}$	4400 W (STH-4KTL-HT) 5500 W (STH-5KTL-HT) 6600 W (STH-6KTL-HT) 8800 W (STH-8KTL-HT) 11000 W (STH-10KTL-HT) 13200 W (STH-12KTL-HT)
	Rated voltage	3/N/PE~, 230/400 Va.c.
Period of measurement:	From 2020-12-10 to 2021-03-20	

Rapid voltage changes and flicker (EN 61000-3-11) – STH-12KTL-HT					
Test condition	$d_{(t)} - 500ms$ [%]	d_c [%]	d_{max} [%]	P_{st}	P_{lt}
Continuous operation	0/0/0	0,27/0,37/0,26	0,59/0,88/0,64	0,15/0,15/0,14	0,1/0,12/0,11
Start	0/0/0	0,13/0,12/0	0,22/0,25/0	-	-
Stop	0/0/0	0,15/0,18/0,09	0,69/0,44/0,37	-	-
Limit	3,3%	3,3%	4%	1,0	0,65

EN 61000-3-12 (STH-12KTL-HT)														
Description	Admissible individual harmonic current I_H/I_{ref} % (Minimum $R_{SCE}=33$)												Admissible harmonic parameters (%)	
	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	I_{10}	I_{11}	I_{12}	I_{13}	THC/ I_{ref}	PWHC/ I_{re} f
Limit:	8,0	-	4,0	10,7	2,7	7,2	2,0	-	1,6	3,1	1,3	2,0	13	22
Actual Value	0,46	0,36	0,49	1,63	0,13	0,99	0,08	0,08	0,21	0,70	0,07	0,43	2,22	3,15

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Harmonics – STH-12KTL-HT											
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100
Ordinal number	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2	0,120	0,289	0,228	0,217	0,203	0,219	0,180	0,226	0,284	0,408	0,456
3	0,086	0,298	0,334	0,334	0,335	0,331	0,334	0,341	0,339	0,353	0,359
4	0,078	0,134	0,102	0,082	0,062	0,096	0,133	0,205	0,288	0,379	0,487
5	0,357	0,613	1,036	1,247	1,332	1,357	1,420	1,418	1,447	1,512	1,627
6	0,024	0,059	0,092	0,095	0,108	0,099	0,114	0,116	0,120	0,131	0,128
7	0,217	0,289	0,554	0,771	0,845	0,781	0,841	0,924	0,964	0,973	0,993
8	0,070	0,094	0,096	0,126	0,126	0,143	0,122	0,109	0,092	0,084	0,081
9	0,067	0,047	0,085	0,106	0,124	0,107	0,101	0,094	0,087	0,088	0,084
10	0,060	0,074	0,091	0,109	0,112	0,137	0,155	0,163	0,171	0,194	0,214
11	0,222	0,112	0,206	0,382	0,490	0,543	0,585	0,595	0,617	0,652	0,700
12	0,020	0,024	0,028	0,040	0,046	0,066	0,059	0,068	0,060	0,068	0,068
13	0,113	0,190	0,156	0,232	0,332	0,362	0,395	0,421	0,447	0,432	0,426
14	0,036	0,032	0,022	0,043	0,045	0,045	0,047	0,047	0,046	0,052	0,054
15	0,020	0,019	0,040	0,039	0,044	0,043	0,045	0,048	0,043	0,049	0,051
16	0,025	0,029	0,022	0,040	0,040	0,048	0,049	0,052	0,053	0,057	0,056
17	0,049	0,176	0,139	0,143	0,212	0,242	0,270	0,291	0,320	0,321	0,326
18	0,013	0,020	0,023	0,026	0,028	0,025	0,026	0,026	0,026	0,024	0,023
19	0,074	0,110	0,119	0,131	0,161	0,179	0,225	0,261	0,322	0,336	0,350
20	0,008	0,019	0,021	0,015	0,015	0,015	0,018	0,015	0,022	0,023	0,028
21	0,022	0,015	0,039	0,017	0,022	0,036	0,044	0,050	0,049	0,055	0,052
22	0,013	0,014	0,010	0,013	0,021	0,014	0,011	0,015	0,020	0,027	0,030
23	0,053	0,022	0,086	0,130	0,104	0,097	0,149	0,190	0,264	0,285	0,301
24	0,006	0,014	0,014	0,017	0,024	0,023	0,023	0,028	0,026	0,034	0,038
25	0,051	0,064	0,082	0,130	0,108	0,065	0,093	0,111	0,163	0,168	0,174
26	0,020	0,015	0,021	0,020	0,020	0,027	0,027	0,028	0,030	0,034	0,035
27	0,016	0,015	0,038	0,022	0,021	0,027	0,034	0,039	0,036	0,044	0,046
28	0,018	0,013	0,013	0,020	0,026	0,029	0,028	0,032	0,034	0,040	0,041
29	0,024	0,103	0,097	0,127	0,092	0,040	0,063	0,081	0,134	0,139	0,140
30	0,007	0,007	0,007	0,010	0,014	0,027	0,026	0,028	0,022	0,022	0,020

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Harmonics – STH-12KTL-HT											
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100
Ordinal number	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
31	0,013	0,089	0,077	0,106	0,155	0,162	0,129	0,144	0,202	0,209	0,210
32	0,012	0,014	0,013	0,010	0,020	0,024	0,018	0,019	0,022	0,025	0,025
33	0,014	0,020	0,033	0,058	0,063	0,033	0,028	0,030	0,026	0,031	0,028
34	0,015	0,008	0,008	0,009	0,010	0,016	0,029	0,015	0,012	0,010	0,012
35	0,025	0,038	0,066	0,126	0,189	0,170	0,131	0,153	0,190	0,166	0,162
36	0,009	0,005	0,006	0,007	0,015	0,017	0,012	0,033	0,019	0,014	0,014
37	0,012	0,018	0,041	0,050	0,064	0,075	0,103	0,246	0,365	0,174	0,131
38	0,008	0,010	0,008	0,006	0,004	0,005	0,025	0,023	0,066	0,029	0,021
39	0,010	0,012	0,007	0,011	0,011	0,011	0,010	0,035	0,063	0,027	0,026
40	0,007	0,009	0,007	0,008	0,008	0,009	0,012	0,030	0,018	0,027	0,020
41	0,006	0,012	0,027	0,035	0,052	0,058	0,094	0,240	0,371	0,206	0,172
42	0,005	0,005	0,004	0,005	0,007	0,008	0,008	0,012	0,058	0,038	0,064
43	0,010	0,010	0,017	0,040	0,052	0,035	0,024	0,029	0,080	0,136	0,361
44	0,005	0,006	0,008	0,007	0,008	0,006	0,007	0,004	0,017	0,027	0,047
45	0,006	0,008	0,007	0,006	0,011	0,011	0,014	0,013	0,019	0,038	0,053
46	0,009	0,006	0,008	0,007	0,007	0,007	0,010	0,006	0,009	0,017	0,050
47	0,014	0,015	0,011	0,027	0,033	0,030	0,035	0,046	0,082	0,155	0,387
48	0,007	0,007	0,007	0,006	0,006	0,006	0,007	0,008	0,008	0,013	0,028
49	0,011	0,017	0,017	0,022	0,030	0,035	0,034	0,045	0,040	0,055	0,088
50	0,004	0,005	0,007	0,007	0,007	0,007	0,009	0,008	0,010	0,009	0,018

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E.6 Certificate of the network and system protection

Certificate of NS protection	No. 70.409.20.012.24-00		
Manufacturer	Ningbo Sunways Technologies Co., Ltd. No. 1, Second Road, Green Industrial Zone, Chongshou Town, 315334 Cixi, Ningbo, Zhejiang, PEOPLE'S REPUBLIC OF CHINA		
Type of NS protection	-		
Central NS protection	<input type="checkbox"/>	-	
Integrated NS protection	<input checked="" type="checkbox"/>	Assigned to power generation unit type	STH-4KTL-HT STH-5KTL-HT STH-6KTL-HT STH-8KTL-HT STH-10KTL-HT STH-12KTL-HT
Network connection rules	VDE-AR-N 4105 "Power generation systems connected to the low-voltage network" Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network		
Test requirement	DIN VDE V 0124-100 (VDE V 0124-100) "Network integration of power generation system – Low voltage" Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network		
The network and system protection mentioned above meets the requirements of VDE-AR-N 4105.			

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E.7 Requirement for the test report for the NS protection

Extract from test report for NS protection "Determination of electrical properties"				No. 70.409.20.012.24-00		
NS protection test report						
Type of NS system:	Integrated NS protection			Other Manufacturer indications		
Software version:	V1.00					
Manufacturer:	Ningbo Sunways Technologies Co., Ltd. No. 1, Second Road, Green Industrial Zone, Chongshou Town, 315334 Cixi, Ningbo, Zhejiang, PEOPLE'S REPUBLIC OF CHINA					
Measuring period:	From 2020-12-10 to 2021-03-20					
	Stirling generators, fuel cells			Inverter		
	Synchronous and asynchronous generators coupled directly or via inverters with $P_n \leq 50$ kW			directly coupled synchronous and asynchronous generators with $P_n > 50$ kW		
Protection function	Setting value	Tripping value	Tripping time NS protection *	Setting value	Tripping value	Break time NS protection *
Rise-in-voltage protection $U >>$	-	-	-	$1,25 * U_n$	L1: 286V L2: 285,8V L3: 285,8V L1-L2: 500,6V L2-L3: 499,8V L3-L1: 501V	L1: 120 ms L2: 123 ms L3: 122 ms L1-L2: 180 ms L2-L3: 173 ms L3-L1: 168 ms
Rise-in-voltage protection $U >$	-	-	-	$1,10 * U_n$	$1,12 * U_n$	ms**
Voltage drop protection $U <$	-	-	-	$0,8 * U_n$	L1: 184V L2: 184V L3: 183,9V L1-L2: 322,2V L2-L3: 321,1V L3-L1: 321,3V	L1: 3047 ms L2: 3041 ms L3: 3041 ms L1-L2: 3068 ms L2-L3: 3064 ms L3-L1: 3062 ms
Voltage drop protection $U <<$		-		$0,45 * U_n$	L1: 103,4V L2: 104V L3: 104,6V L1-L2: 179,3V L2-L3: 180,9V L3-L1: 181,1V	L1: 353 ms L2: 324 ms L3: 385 ms L1-L2: 375 ms L2-L3: 365 ms L3-L1: 359 ms
Frequency decrease protection $f <$	-	-	-	47,5 Hz	47,49 Hz	149 ms
Frequency increase protection $f >$	-	-	-	51,5 Hz	51,51 Hz	184 ms

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*: The tripping time includes the period from the limit value violation U/f until the tripping signal to the interface switch.
 When planning the power generation system, the response time of the interface switch shall be added to the maximum time value obtained as indicated above.
 The disconnection time (sum of tripping time of the NS protection plus response time of the interface switch) shall not exceed 200 ms.

** : Verification disconnection time of moving 10-min-average value.

Disconnecting time as below:

1. 476,471 s (L1) / 485,882 s (L2) / 468,235 s (L3) (from 600s@ U_n to 112% U_n)
2. Continuous operation (from 600s@ U_n to 108% U_n)
3. 305,613 s (L1) / 328,824 s (L2) / 248,235 s (L3) (from 600s@106% U_n to 114% U_n)

<input checked="" type="checkbox"/> as integrated NS protection	
Assigned to power generation unit type	STH-4KTL-HT STH-5KTL-HT STH-6KTL-HT STH-8KTL-HT STH-10KTL-HT STH-12KTL-HT
Integrated interface switch type	Series-connected relays for both line and neutral conductors Relay type: ALFG2PF121, HF161F-W/12-HT, AZSR131-1AE-12D, AZSR131-1AE-12D(200)
Response time of interface switch for integrated NS protection	Operate time: Max. 20 ms (ALFG2PF121, HF161F-W/12-HT, AZSR131-1AE-12D, AZSR131-1AE-12D(200)) Release time: Max. 10 ms (ALFG2PF121, HF161F-W/12-HT, AZSR131-1AE-12D, AZSR131-1AE-12D(200))
Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.	<input checked="" type="checkbox"/>

Tested according to:

VDE-AR-N 4105:2018
 DIN VDE V 0124-100 (VDE V 0124-100):2020