CERTIFICATE OF CONFORMITY

Issued to:	Ningbo Sunways Technologies Co., Ltd. No.1, Second Road, Green Industrial Zone, Chongshou Town, 315334 Cixi, Ningbo, ZheJiang, PEOPLE'S REPUBLIC OF CHINA
For the product:	Hybrid Inverter
Trade name:	sunways
Type/Model:	STH-4KTL-LS, STH-4.6KTL-LS, STH-5KTL-LS, STH-6KTL-LS, STH-7.5KTL-LS, STH-8KTL-LS
Ratings:	See Annex
Manufactured by:	Ningbo Sunways Technologies Co., Ltd. No.1, Second Road, Green Industrial Zone, Chongshou Town, 315334 Cixi, Ningbo, ZheJiang, PEOPLE'S REPUBLIC OF CHINA
Requirements:	Engineering Recommendation G99 Issue 1 – Amendment 10: 2024 (G99/1-10:2024) (Requirements for Type A Generating Module)

This Test Certificate is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6234690.50.

The examination has been carried out on one single specimen of the product. The Attestation does not include an assessment of the manufacturer's production. Conformity of this production with the specimen tested by DEKRA is not the responsibility of DEKRA.

This Test Certificate expires at the latest on 2030-11-07 or expires upon withdrawal of one of the above mentioned standards.

Shanghai, 2025-11-07 Certificate Number: 6234690.01COC

DEKRA Testing and Certification (Shanghai) Ltd.

Kreny Lin
Certification Manager

PCA-141

DEKRA Testing and Certification (Shanghai) Ltd.
No.250, Jiangchangsan Road, Jing'an District, Shanghai, 200436 People's Republic of China
T +86 21 6056 7600 F +86 21 6056 7555 www.dekra-product-safety.com

Annex to 6234690.01COC

Ratings of the test product:

Model	STH-4KTL-LS	STH-4.6KTL-LS	STH-5KTL-LS	STH-6KTL-LS	STH-7.5KTL-LS	STH-8KTL-LS
PV Input						
Vmax PV (Vdc) (absolute Max.)	600	600	600	600	600	600
Rated DC Input Voltage (Vdc)	360	360	360	360	360	360
Isc PV (absolute Max.) (A)	25 / 25	25 / 25	25 / 25	25 / 25	25 / 25	25 / 25
Max. Input Current (A)	20 / 20	20 / 20	20 / 20	20 / 20	20 / 20	20 / 20
MPPT Voltage Range (Vdc)	80-550	80-550	80-550	80-550	80-550	80-550
No. of MPP Trackers	2	2	2	2	2	2
No. of DC Input per MPPT	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
Battery Input						
Battery Voltage Range (Vdc)	40-60	40-60	40-60	40-60	40-60	40-60
Max. Charge / Discharge Current	100/ 100	100/ 100	120 / 120	120 / 120	160 / 160	160 / 160
AC Grid (output)						
Rated Output Voltage (Vac)	L/N/PE, 220 / 230					
Frequency (Hz)	50 / 60					
Rated Output current (A)	17.4	20	21.7	26.1	32.6	34.8
Max. Output Current (A)	20	23	25	30	37.5	40
Rated Output Power (W)	4000	4600	5000	6000	7500	8000
Max. Output Power (W)	4400	5060	5500	6600	8250	8800
Rated Apparent Power (VA)	4000	4600	5000	6000	7500	8000
Max. Apparent Power (VA)	4400	5060	5500	6600	8250	8800
Power factor (adjustable)	0.8 leading … 0.8 lagging					
Others						
Protective class	Class I					
Ingress protection (IP)	IP66					
Operating Temperature	-25°C to +60°C					
Topology	Non-isolated					
Overvoltage category	OVC III (AC Main), OVC II (PV)					

G99/1-10: A2-3 Compliance Verification Report –Tests for Type A Inverter Connected Power Generating Modules
Extract from test report number: 6234690.50

1. Operating Range:	P

Tests should be carried with the **Power Generating Module** operating at **Registered Capacity** and connected to a suitable test supply or grid simulation set. The power supplied by the primary source shall be kept stable within ± 5 % of the apparent power value set for the entire duration of each test sequence.

Frequency, voltage and **Active Power** measurements at the output terminals of the **Power Generating Module** shall be recorded every second. The tests will verify that the **Power Generating Module** can operate within the required ranges for the specified period of time.
The **Interface Protection** shall be disabled during the tests.
In case of a PV **Power Park Module** the PV primary source may be replaced by a DC source.
In case of a full converter **Power Park Module** (eg wind) the primary source and the prime mover I**nverter**/rectifier may be replaced by a DC source.
Pass or failure of the test should be indicated in the fields below (right hand side), for example with the statement “Pass”, “No disconnection occurs”, etc. Graphical evidence is preferred.

Note that the value of voltage stated in brackets assumes a **LV** connection. This should be adjusted for **HV** as required.

Model: STH-8KTL-LS	P

Test 1:

Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (seconds)
195.53	47.00	7424.74	0.9960	30.0

Test 2:

Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
195.55	47.50	7437.20	0.9956	91.0

Test 3:

Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.05	51.50	7932.20	0.9976	91.0

Test 4:

Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.05	52.00	7931.66	0.9976	15.5

Test 5:

Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
230.28	50.00	7940.73	0.9967	91.0

Test 6:

Measured Voltage (V)	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
195.61	47.0 Hz to 52.0 Hz	+1.0 Hzs^{-1}	5.00	No trip
253.03	52.0 Hz to 49.0 Hz	-0.99 Hzs^{-1}	3.02	No trip

2. Power Quality – Harmonics:	P

For **Power Generating Modules** of **Registered Capacity** of less than 75 A per phase (ie 50 kW) the test requirements are specified in Annex A.7.1.5**.** These tests should be carried out as specified in BS EN 61000-3-12, and measurements for the 2nd – 13th harmonics should be provided. The results need to comply with the limits of Table 2 of BS EN 61000-3-12 for single phase equipment and Table 3 of BS EN 610000-3-12 for three phase equipment. For three phase **Power Generating Modules**, measurements for all phases should be provided.

For **Power Generating Modules** of **Registered Capacity** of greater than 75 A per phase (ie 50 kW) the installation must be designed in accordance with EREC G5.

The rating of the **Power Generating Module** (per phase) should be provided below, and the Total Harmonic Distortion (THD) and Partial Weighted Harmonic Distortion (PWHD) should be provided at the bottom of this section.

Model: STH-8KTL-LS

Power Generating Module tested to BS EN 61000-3-12

Power Generating Module rating per phase (rpp)	8	kVA	Harmonic % = Measured Value (A) x 23/rating per phase (kVA)
Single or three phase measurements (for single phase measurements, only complete L1 columns below)	Single phase		

Harmonic	At 45-55% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.008	-	-	0.023	-	-	8%	8%
3	0.110	-	-	0.317	-	-	21.6%	Not stated
4	0.002	-	-	0.007	-	-	4%	4%
5	0.082	-	-	0.236	-	-	10.7%	10.7%
6	0.002	-	-	0.005	-	-	2.67%	2.67%
7	0.043	-	-	0.124	-	-	7.2%	7.2%
8	0.001	-	-	0.004	-	-	2%	2%
9	0.047	-	-	0.136	-	-	3.8%	Not stated
10	0.001	-	-	0.004	-	-	1.6%	1.6%
11	0.027	-	-	0.078	-	-	3.1%	3.1%
12	0.001	-	-	0.004	-	-	1.33%	1.33%
13	0.028	-	-	0.079	-	-	2%	2%
THD	-	-	-	0.45	-	-	23%	13%
PWHD	-	-	-	0.66	-	-	23%	22%
Harmonic	At 100% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.017	-	-	0.049	-	-	8%	8%
3	0.084	-	-	0.241	-	-	21.6%	Not stated

4	0.003	-	-	0.009	-	-	4%	4%
5	0.153	-	-	0.439	-	-	10.7%	10.7%
6	0.002	-	-	0.007	-	-	2.67%	2.67%
7	0.023	-	-	0.067	-	-	7.2%	7.2%
8	0.002	-	-	0.005	-	-	2%	2%
9	0.133	-	-	0.383	-	-	3.8%	Not stated
10	0.002	-	-	0.006	-	-	1.6%	1.6%
11	0.171	-	-	0.491	-	-	3.1%	3.1%
12	0.002	-	-	0.007	-	-	1.33%	1.33%
13	0.111	-	-	0.318	-	-	2%	2%
THD	-	-	-	0.86	-	-	23%	13%
PWHD	-	-	-	1.58	-	-	23%	22%

Model: STH-4KTL-LS								
Power Generating Module tested to BS EN 61000-3-12								
Power Generating Module rating per phase (rpp)				4	kVA		Harmonic % = Measured Value (A) x 23/rating per phase (kVA)	
Single or three phase measurements (for single phase measurements, only complete L1 columns below)				Single phase				
Harmonic	At 45-55% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.007	-	-	0.039	-	-	8%	8%
3	0.111	-	-	0.641	-	-	21.6%	Not stated
4	0.002	-	-	0.012	-	-	4%	4%
5	0.054	-	-	0.312	-	-	10.7%	10.7%
6	0.002	-	-	0.009	-	-	2.67%	2.67%
7	0.031	-	-	0.178	-	-	7.2%	7.2%
8	0.001	-	-	0.008	-	-	2%	2%
9	0.039	-	-	0.223	-	-	3.8%	Not stated
10	0.001	-	-	0.008	-	-	1.6%	1.6%
11	0.027	-	-	0.158	-	-	3.1%	3.1%
12	0.001	-	-	0.008	-	-	1.33%	1.33%
13	0.029	-	-	0.169	-	-	2%	2%
THD	-	-	-	0.80			23%	13%
PWHD	-	-	-	1.85			23%	22%

Harmonic	At 100% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.009	-	-	0.053	-	-	8%	8%
3	0.110	-	-	0.634	-	-	21.6%	Not stated
4	0.002	-	-	0.013	-	-	4%	4%
5	0.081	-	-	0.467	-	-	10.7%	10.7%
6	0.002	-	-	0.011	-	-	2.67%	2.67%
7	0.043	-	-	0.249	-	-	7.2%	7.2%
8	0.001	-	-	0.008	-	-	2%	2%
9	0.047	-	-	0.271	-	-	3.8%	Not stated
10	0.001	-	-	0.008	-	-	1.6%	1.6%
11	0.027	-	-	0.156	-	-	3.1%	3.1%
12	0.002	-	-	0.009	-	-	1.33%	1.33%
13	0.027	-	-	0.158	-	-	2%	2%
THD	-	-	-	0.90	-	-	23%	13%
PWHD	-	-	-	1.35	-	-	23%	22%

Note：
THD = Total Harmonic Distortion of 1^{st} ~ 13^{th} harmonics
PWHD = Partial Weighted Harmonic Distortion of 14^{th} ~ 40^{th} harmonics

3. Power Quality – Voltage fluctuations and Flicker:	**P**

For **Power Generating Modules** of **Registered Capacity** of less than 75 A per phase (ie 50 kW) these tests should be undertaken in accordance with Annex A.7.1.4.3. Results should be normalised to a standard source impedance, or if this results in figures above the limits set in BS EN 61000-3-11 to a suitable Maximum Impedance.

For **Power Generating Modules** of **Registered Capacity** of greater than 75 A per phase (ie 50 kW) the installation must be designed in accordance with EREC P28.
The standard test impedance is 0.4 Ω for a single phase **Power Generating Module** (and for a two phase unit in a three phase system) and 0.24 Ω for a three phase **Power Generating Module** (and for a two phase unit in a split phase system). Please ensure that both test and standard impedance are completed on this form. If the test impedance (or the measured impedance) is different to the standard impedance, it must be normalised to the standard impedance as follows (where the **Power Factor** of the generation output is 0.98 or above):
d max normalised value = (Standard impedance / Measured impedance) x Measured value.
Where the **Power Factor** of the output is under 0.98 then the X to R ratio of the test impedance should be close to that of the standard impedance.
The stopping test should be a trip from full load operation.
The duration of these tests needs to comply with the particular requirements set out in the testing notes for the technology under test.

The test date and location must be declared.

Model:	STH-8KTL-LS		
Test start date	2025-09-29	Test end date	2025-09-29
Test location	No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China		

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.371%	0.258%	0.000%	0.912%	0.276%	0.000%	0.270	0.261
Normalised to standard impedance	0.501%	0.348%	0.000%	1.231%	0.373%	0.000%	0.365	0.352
Normalised to required maximum impedance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Limits set under BS EN 61000-3-11	4%	3.3%	3.3% 500 ms	4%	3.3%	3.3% 500 ms	1.0	0.65

Test Impedance	R	0.333	Ω	Xl	0.105	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A	Ω	Xl	N/A	Ω

Annex to 6234690.01COC

Model:	STH-4KTL-LS		
Test start date	2025-09-29	Test end date	2025-09-29
Test location	No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China		

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.404%	0.034%	0.000%	0.499%	0.155%	0.000%	0.278	0.257
Normalised to standard impedance	0.545%	0.046%	0.000%	0.674%	0.209%	0.000%	0.375	0.347
Normalised to required maximum impedance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Limits set under BS EN 61000-3-11	4%	3.3%	3.3% 500 ms	4%	3.3%	3.3% 500 ms	1.0	0.65

Test Impedance	R	0.333	Ω	XI	0.105	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	XI	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A	Ω	XI	N/A	Ω

* Applies to three phase and split single phase **Power Generating Modules.**

^ Applies to single phase **Power Generating Module** and **Power Generating Modules** using two phases on a three phase system. Delete as appropriate.

4. Power quality – DC injection:			**P**
The tests should be carried out on a single **Generating Unit**. Tests are to be carried out at three defined power levels ±5%. At 230 V a 50 kW three phase **Inverter** has a current output of 217 A so DC limit is 543 mA. These tests should be undertaken in accordance with Annex A.7.1.4.4. The % DC injection ("as % of rated AC current" below) is calculated as follows: % DC injection = Recorded DC value in Amps / Base current where the base current is the **Registered Capacity** (W) / Vphase. The % DC injection should not be greater than 0.25%.			
Model: STH-8KTL-LS			
Test power level	10%	55%	100%
Recorded DC injection value in Amps	0.064	0.053	0.041
as % of rated AC current	0.185%	0.151%	0.118%
Limit	0.25%	0.25%	0.25%
Model: STH-4KTL-LS			
Test power level	10%	55%	100%
Recorded DC injection value in Amps	0.024	0.029	0.031
as % of rated AC current	0.136%	0.165%	0.180%
Limit	0.25%	0.25%	0.25%

5. Power Factor:			**P**
The tests should be carried out on a single **Power Generating Module**. Tests are to be carried out at three voltage levels and at **Registered Capacity** and the measured **Power Factor** must be greater than 0.95 to pass. Voltage to be maintained within ±1.5% of the stated level during the test. These tests should be undertaken in accordance with Annex A.7.1.4.2 Note that the value of voltage stated in brackets assumes a **LV** connection. This should be adjusted for **HV** as required.			
Model: STH-8KTL-LS			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9961	0.9969	0.9978
Power Factor Limit	>0.95	>0.95	>0.95
Model: STH-4KTL-LS			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9987	0.9987	0.9984
Power Factor Limit	>0.95	>0.95	>0.95

6. Protection – Frequency tests:						P
These tests should be carried out in accordance with the Annex A.7.1.2.3. For trip tests, frequency and time delay should be stated. For “no trip tests”, “no trip” can be stated.						
Model: STH-8KTL-LS						
Function	Setting		Trip test		“No trip tests”	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.49 Hz	20.050 s	47.7 Hz 30 s	No trip
U/F stage 2	47.0 Hz	0.5 s	46.99 Hz	0.527 s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F	52.0 Hz	0.5 s	52.01 Hz	0.526 s	51.8 Hz 120 s	No trip
					52.2 Hz 0.45 s	No trip
Note: For frequency trip tests the frequency required to trip is the setting ± 0.1 Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The “No trip tests” need to be carried out at the setting ± 0.2 Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

7. Protection – Voltage tests:						P
These tests should be carried out in accordance with Annex A.7.1.2.2. For trip tests, voltage and time delay should be stated. For “no trip tests”, “no trip” can be stated. Note that the value of voltage stated below assumes a **LV** connection This should be adjusted for **HV** taking account of the VT ratio as required.						
Model: STH-8KTL-LS						
L1-N						
Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V	0.8 pu (184 V)	2.5 s	182.81 V	2.540s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	1.14 pu (262.2 V)	1.0 s	263.57 V	1.040 s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5 s	274.56 V	0.530 s	269.7 V 0.95 s	No trip
					277.7 V 0.45 s	No trip
Note: for Voltage tests the Voltage required to trip is the setting ±3.45 V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4 V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

8. Protection – Loss of Mains test:	P

These tests should be carried out in accordance with BS EN 62116. Annex A.7.1.2.4.
For test condition A, EUT output = 100 % P_n, test condition B, EUT output = 50 % to 66 % P_n, and test condition C, EUT output = 25 % to 33 % P_n.

Model: STH-8KTL-LS

The following sub set of tests should be recorded in the following table.

Test Power and imbalance	33% -5% Q Test 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. **Limit is 0.5s**	0.144 s	0.134 s	0.204 s	0.149 s	0.142 s	0.188 s

No.	P_{EUT} a) (% of EUT rating)	Reactive load (% of Q_L)	P_{AC} b) (% of nominal)	Q_{AC} c) (% of nominal)	Run-on time (ms)	P_{EUT} (W)	Actual Q_f	V_{DC} d)	Remarks e)
1	100	100	0	0	237	8000	1.002	450	Test A at BL
2	66	66	0	0	276	5280	1.000	300	Test B at BL
3	33	33	0	0	377	2640	1.000	250	Test C at BL
4	100	100	-5	-5	143	8000	0.976	450	Test A at IB
5	100	100	-5	0	204	8000	0.952	450	Test A at IB
6	100	100	-5	+5	148	8000	0.935	450	Test A at IB
7	100	100	0	-5	150	8000	1.024	450	Test A at IB
8	100	100	0	+5	168	8000	0.974	450	Test A at IB
9	100	100	+5	-5	167	8000	1.080	450	Test A at IB
10	100	100	+5	0	188	8000	1.060	450	Test A at IB
11	100	100	+5	+5	140	8000	1.027	450	Test A at IB
12	66	66	0	-5	134	5280	1.027	300	Test B at IB
13	66	66	0	-4	156	5280	1.020	300	Test B at IB
14	66	66	0	-3	158	5280	1.018	300	Test B at IB
15	66	66	0	-2	169	5280	1.007	300	Test B at IB
16	66	66	0	-1	170	5280	1.000	300	Test B at IB
17	66	66	0	+1	222	5280	0.997	300	Test B at IB
18	66	66	0	+2	221	5280	0.990	300	Test B at IB
19	66	66	0	+3	190	5280	0.986	300	Test B at IB
20	66	66	0	+4	160	5280	0.950	300	Test B at IB
21	66	66	0	+5	142	5280	0.973	300	Test B at IB
22	66	66	0	-5	144	2640	1.031	170	Test B at IB
23	33	33	0	-4	156	2640	1.014	170	Test C at IB
24	33	33	0	-3	168	2640	1.014	170	Test C at IB
25	33	33	0	-2	167	2640	1.011	170	Test C at IB
26	33	33	0	-1	177	2640	0.994	170	Test C at IB
27	33	33	0	+1	211	2640	0.994	170	Test C at IB

28	33	33	0	+2	210	2640	0.991	170	Test C at IB
29	33	33	0	+3	195	2640	0.983	170	Test C at IB
30	33	33	0	+4	193	2640	0.980	170	Test C at IB
31	33	33	0	+5	149	2640	0.974	170	Test C at IB

Note:

a) P_{EUT}: EUT output power.
b) P_{ac}: Active power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
c) Q_{ac}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
d) For test condition A, > 75 % of rated input voltage range used, for test condition B, 50 % of rated input voltage range, ±10 % used, for test condition C, < 20 % of rated input voltage range used. Based on EUT rated input operating range. For example, if range is between X volts and Y volts, 75 % of range = X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.
e) BL: Balance condition, IB: Imbalance condition.

If the device requires additional shut down time (beyond 0.5 s but less than 1 s) then this should be stated on this form.

8. Loss of Mains Protection, Vector Shift Stability test			**P**
This test should be carried out in accordance with Annex A.7.1.2.6. Confirmation is required that the **Power Generating Module** does not trip under positive / negative vector shift.			
Model: STH-8KTL-LS			
	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.5 Hz	+50 degrees	No trip
Negative Vector Shift	50.5 Hz	- 50 degrees	No trip

8. Loss of Mains Protection, RoCoF Stability test:			**P**
This test should be carried out in accordance with Annex A.7.1.2.6. Confirmation is required that the **Power Generating Module** does not trip for the duration of the ramp up and ramp down test.			
Model: STH-8KTL-LS			
Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0 Hz to 51.0 Hz	+0.93 Hzs^{-1}	2.16 s	No trip
51.0 Hz to 49.0 Hz	-0.93 Hzs^{-1}	2.14 s	No trip

9-1. Limited Frequency Sensitive Mode – Over frequency test					**P**
The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 10%. This test should be carried out in accordance with A.7.1.3, which also contains the measurement tolerances.					
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.7.2.4					N/A
Model: STH-8KTL-LS					
Alternatively, simulation results should be noted below:					
Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient ($\%P_a s^{-1}$)
Step a) 50.00 Hz ±0.01 Hz	7940.40	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	7860.76	50.45	9.90		-
Step c) 50.70 Hz ±0.10 Hz	7459.03	50.70	9.96		-
Step d) 51.15 Hz ±0.05 Hz	6737.21	51.15	9.97		-
Step e) 50.70 Hz ±0.10 Hz	7465.47	50.70	9.89		-
Step f) 50.45 Hz ±0.05 Hz	7866.36	50.45	9.98		-
Step g) 50.00 Hz ±0.01 Hz	7945.89	50.00	9.92		
Test sequence at **Registered Capacity** 40-60%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient ($\%P_a s^{-1}$)
Step a) 50.00 Hz ±0.01 Hz	4026.48	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	3946.23	50.45	9.97		-
Step c) 50.70 Hz ±0.10 Hz	3544.08	50.70	9.95		-
Step d) 51.15 Hz ±0.05 Hz	2823.46	51.15	9.99		-
Step e) 50.70 Hz ±0.10 Hz	3545.23	50.70	9.98		-
Step f) 50.45 Hz ±0.05 Hz	3947.61	50.45	9.94		-
Step g) 50.00 Hz ±0.01 Hz	4027.73	50.00	9.99		
The frequency at each step should be maintained for at least one minute and the Active Power reduction in the form of a gradient determined and assessed for compliance with paragraph 11.2.3. The Droop should be determined from the measurements between 50.4 Hz and 51.15 Hz. The allowed tolerance for the frequency measurement shall be ± 0.05 Hz. The allowed tolerance for Active Power output measurement shall be ±10% of the required change in Active Power. The resulting overall tolerance range for a nominal 10% Droop is +2.8% and – 1.5%, ie a Droop less than 12.8% and greater than 8.5%.					

9-2. Power output with falling frequency test (For PV Inverter)				P
Tests should prove that the **Power Generating Module** does not reduce output power as the frequency falls. These tests should be carried out in accordance with 11.2.3.1, 12.2.3.1, 13.2.3.1.				
Model: STH-8KTL-LS				
Test sequence	Measured **Active Power** Output (W)	Acceptable **Active Power**	Frequency (Hz)	Primary power source
50.5 Hz for 5 minutes	7938.21	100% **Registered Capacity**	50.50	Photovoltaic array simulator
50.0 Hz for 5 minutes	7938.88	100% **Registered Capacity**	50.00	Photovoltaic array simulator
49.5 Hz for 5 minutes	7938.12	100% **Registered Capacity**	49.50	Photovoltaic array simulator
49.0 Hz for 5 minutes	7939.40	99% **Registered Capacity**	48.50	Photovoltaic array simulator
48.0 Hz for 5 minutes	7939.92	97% **Registered Capacity**	48.00	Photovoltaic array simulator
47.6 Hz for 5 minutes	7940.48	96.2% **Registered Capacity**	47.60	Photovoltaic array simulator
47.1 Hz for 20 s	7940.70	95% **Registered Capacity**	47.10	Photovoltaic array simulator

9-3. Power output with falling frequency test (For Electricity Storage Device)				P
This test should be carried out in accordance with clause 11.2.3.3, 12.2.3.3, 13.2.3.2 and A.7.1.7				
Model:				
Test 1: 50 Hz to 49.0 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-7903.44	50.00	-	AC grid / Storage Battery
49.5	-7751.89	49.50	-	AC grid / Storage Battery
49.2	-2979.96	49.20	1.01%	AC grid / Storage Battery
49.0	195.54	49.00	1.01%	AC grid / Storage Battery
Test 2: 50 Hz to 48.8 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-7883.53	50.00	-	AC grid / Storage Battery
49.5	-7735.87	49.50	-	AC grid / Storage Battery
49.2	-2964.39	49.20	1.01%	AC grid / Storage Battery
49.0	211.23	49.00	1.01%	AC grid / Storage Battery
48.9	1799.97	48.90	1.01%	AC grid / Storage Battery
48.8	3301.10	48.80	1.07%	AC grid / Storage Battery

Test 3: 50 Hz to 49.0 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-3187.14	50.00	-	AC grid / Storage Battery
49.5	-3027.53	49.50	-	AC grid / Storage Battery
49.2	1736.43	49.20	1.01%	AC grid / Storage Battery
49.0	4912.61	49.00	1.01%	AC grid / Storage Battery
Test 4: 50 Hz to 48.8 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-3186.67	50.00	-	AC grid / Storage Battery
49.5	-3027.91	49.50	-	AC grid / Storage Battery
49.2	1735.35	49.20	1.01%	AC grid / Storage Battery
49.0	4911.77	49.00	1.01%	AC grid / Storage Battery
48.9	6502.01	48.90	1.01%	AC grid / Storage Battery
48.8	7504.70(1)	48.80	1.60%(2)	AC grid / Storage Battery

10. Protection – Re-connection timer.					**P**
Model: STH-8KTL-LS					
Test should prove that the reconnection sequence starts after a minimum delay of 20 s for restoration of voltage and frequency to within the stage 1 settings of Table 10.1.					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of Table 10.1.			
60 s	61.80 s	At 1.16 pu (266.2 V)	At 0.78 pu (180.0 V)	At 47.4 Hz	At 52.1 Hz
Confirmation that the **Micro-generator** does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection
Recover to normal operation range after confirmation of no connection		Yes	Yes	Yes	Yes
Confirmation that the Power Generating Module shall reconnect		Reconnection after 61.80 s	Reconnection after 61.80 s	Reconnection after 61.51 s	Reconnection after 61.31 s

11. Fault level contribution:		**P**
These tests shall be carried out in accordance with EREC G99 Annex A.7.1.5. Please complete each entry, even if the contribution to the fault level is zero.		
Model: STH-8KTL-LS		
For **Inverter** output		
Time after fault	Volts	Amps
20ms	31.5	34.2
100ms	31.6	38.3
250ms	29.9	1.17
500ms	30.0	1.17
Time to trip	0.147	In seconds

12. Self-Monitoring solid state switching: No specified test requirements. Refer to Annex A.7.1.6.	
It has been verified that in the event of the solid state switching device failing to disconnect the **Power Park Module**, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 s.	N/A
13. Wiring functional tests: If required by para 15.2.1.	
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning)	N/A
14. Logic interface (input port).	
Confirm that an input port is provided and can be used to shut down the module.	Yes
Logic interface marked 'COM' on inverter which can be operated by a switch. When the switch is open the inverter can operate normally. When the switch is closed, the inverter will reduce its output voltage to below 30V within 30s.	
Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal (the additional comments box below can be used)	Yes
15. Cyber security	
Confirm that the Power Generating Module has been designed to comply with cyber security requirements, as detailed in 9.1.7.	Yes Manufacturer's declaration provided
Additional comments.	
All communication ports are hidden behind the communicationn terminal at the bottom of inverter which include CT port, BMS port, EMS port, DRED port, Meter port, EV port. Sunways grid connected PV inverter comes standard with one key to shut off function, and you can use this function by connecting an external switch into the DRED interface if it requires in the installation place. The external switch doesn't include in our accessory box. Connect terminal 5 & 6 of DRRD port 1 with the external switch connection. When the switch is open, the inverter will operate normally. When the switch is closed. The inverter will cease to export active power within 5 seconds	

---------END-------