ATTESTATION OF CONFORMITY

Issued to:	Afore New Energy Technology (Shanghai) Co., Ltd. Build No.7, 333 Wanfang Road, Minhang District, Shanghai, China
For the product:	Grid-connected photovoltaic inverter
Trade name:	Afore
Type/Model:	HNS4000TL, HNS5000TL, HNS6000TL, HNS7000TL, HNS8000TL
Ratings:	See Annex
Manufactured by:	Afore New Energy Technology (Shanghai) Co., Ltd. Build No.7, 333 Wanfang Road, Minhang District, Shanghai, China
Requirements:	Engineering Recommendation G99 Issue 1 Amendment 6 2020

This Attestation is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no 6076148.50.

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

Arnhem, 22 July 2020 Number: 6076148.01AOC

DEKRA Testing and Certification (Shanghai) Ltd.

Kreny Lin
Certification Manager

DEKRA Testing and Certification (Shanghai) Ltd.
3F #250 Jiangchangsan Road Building 16 Headquarter Economy Park Shibei Hi-Tech Park, Jing'an District, Shanghai 200436 China
T +86 21 6056 7600 F +86 21 6056 7555 www.dekra-certification.com

HNS4000TL:
PV input: Max. 600 Vdc, MPPT voltage range: 70-550 Vdc, max 14 A/14 A, Isc PV: 18 A/18 A
Output: 230 Vac, 50 Hz, max 4400 VA, max 20 A

HNS5000TL:
PV input: Max. 600 Vdc, MPPT voltage range: 70-550 Vdc, max 14 A/14 A, Isc PV: 18 A/18 A
Output: 230 Vac, 50 Hz, max 5500 VA, max 23 A

HNS6000TL:
PV input: Max. 600 Vdc, MPPT voltage range: 70-550 Vdc, max 14 A/14 A, Isc PV: 18 A/18 A
Output: 230 Vac, 50 Hz, max 6600 VA, max 27 A

HNS7000TL:
PV input: Max. 600 Vdc, MPPT voltage range: 70-550 Vdc, max 28 A/14 A, Isc PV: 35 A/18 A
Output: 230 Vac, 50 Hz, max 7700 VA, max 32 A

HNS8000TL:
PV input: Max. 600 Vdc, MPPT voltage range: 70-550 Vdc, max 28 A/14 A, Isc PV: 35 A/18 A
Output: 230 Vac, 50 Hz, max 8800 VA, max 35.5 A

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G99/1-6 Form A2-3 Compliance Verification Report-Test for Type A Inverter	
Extract form test report number.:	**6076148.50**

1. Operating Range: Four 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.

Test 1
Voltage = 85% of nominal (195.5 V),
Frequency = 47 Hz,
Power Factor = 1,
Period of test 20 s

Test 2
Voltage = 85% of nominal (195.5 V),
Frequency = 47.5 Hz,
Power Factor = 1,
Period of test 90 minutes

Test 3
Voltage = 110% of nominal (253 V),
Frequency = 51.5 Hz,
Power Factor = 1,
Period of test 90 minutes

Test 4
Voltage = 110% of nominal (253 V),
Frequency = 52.0 Hz,
Power Factor = 1,
Period of test 15 minutes

Test 5 RoCoF withstand

Confirm that the **Power Generating Module** is capable of staying connected to the **Distribution Network** and operate at rates of change of frequency up to 1 Hzs^{-1} as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site.

Model: HNS8000TL

Test 1				P
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (seconds)
195.55	47	4280.86	0.9980	20
Test 2				**P**
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
195.55	47.5	3996.65	0.9975	90
Test 3				**P**
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.49	51.50	4938.12	0.9936	90
Test 4				**P**

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Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.25	52.00	4929.90	0.9938	15
Test 5				P
Measured Voltage (V)	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
195.5	47.0 Hz to 52.0 Hz	+1 Hzs^{-1}	5.0 s	No trip
253.0	52.0 Hz to 49.0 Hz	-1 Hzs^{-1}	3.0 s	No trip

2. Power Quality – Harmonics:

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 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.
Power Generating Modules with emissions close to the limits laid down in BS EN 61000-3-12 may require the installation of a transformer between 2 and 4 times the rating of the **Power Generating Module** in order to accept the connection to a **Distribution Network.**
For **Power Generating Modules** of **Registered Capacity** of greater than 75 A per phase (ie 50 kW) the installation shall be designed in accordance with EREC G5.

P

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

Model: HNS8000TL

Power Generating Module rating per phase (rpp)			8.0	kVA	Harmonic % = Measured Value (A) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of **Registered Capacity**		100% of **Registered Capacity**		Limit in BS EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.0603	0.173	0.0705	0.203	8%	8%
3	0.1577	0.453	0.2054	0.591	21.6%	Not stated
4	0.0128	0.037	0.0214	0.062	4%	4%
5	0.0597	0.172	0.0937	0.269	10.7%	10.7%
6	0.0110	0.032	0.0179	0.052	2.67%	2.67%
7	0.0348	0.100	0.0634	0.182	7.2%	7.2%
8	0.0097	0.028	0.0185	0.053	2%	2%
9	0.0326	0.094	0.0705	0.203	3.8%	Not stated
10	0.0087	0.025	0.0091	0.026	1.6%	1.6%
11	0.0144	0.041	0.0207	0.059	3.1%	3.1%
12	0.0099	0.028	0.0095	0.027	1.33%	1.33%
13	0.0116	0.033	0.0194	0.056	2%	2%
THD	--	1.31	---	1.78	23%	13%
PWHD	--	1.23	---	1.49	23%	22%

Model: HNS4000TL

Power **Generating Module** rating per phase (rpp)			4.0	kVA	Harmonic % = Measured Value (A) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of **Registered Capacity**		100% of **Registered Capacity**		Limit in BS EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase

2	0.0379	0.109	0.0271	0.078	8%	8%
3	0.2218	0.638	0.0814	0.234	21.6%	Not stated
4	0.0093	0.027	0.0063	0.018	4%	4%
5	0.0902	0.259	0.0276	0.079	10.7%	10.7%
6	0.0103	0.030	0.0059	0.017	2.67%	2.67%
7	0.0521	0.150	0.0182	0.052	7.2%	7.2%
8	0.0107	0.031	0.0057	0.017	2%	2%
9	0.0356	0.102	0.0158	0.046	3.8%	Not stated
10	0.0099	0.028	0.0055	0.016	1.6%	1.6%
11	0.0213	0.061	0.0075	0.022	3.1%	3.1%
12	0.0100	0.029	0.0059	0.017	1.33%	1.33%
13	0.0184	0.053	0.0065	0.019	2%	2%
THD	--	1.15	---	1.76	23%	13%
PWHD	--	1.33	---	1.49	23%	22%

3. Power Quality – Voltage fluctuations and Flicker:	
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 shall be designed in accordance with EREC P28.	**P**

Model: HNS8000TL

	Starting			Stopping			Running	
	d max	d c	d(t)	d max	d c	d(t)	Pst	Plt 2 hours
Measured Values at test impedance	0.56%	0.27%	0	1.43%	0.16%	0	0.22	0.19
Normalised to standard impedance	0.56%	0.27%	0	1.43%	0.16%	0	0.22	0.19
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%	4%	3.3%	3.3%	1.0	0.65

Test Impedance	R	0.4	Ω	Xl	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.15 * 0.25 ^	Ω
Maximum Impedance	R	NA	Ω	Xl	NA	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
For voltage change and flicker measurements the following formula is to be used to convert the measured values to the normalised values where the **Power Factor** of the generation output is 0.98 or above.
Normalised value = Measured value x reference source resistance/measured source resistance at test point

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Single phase units reference source resistance is 0.4 Ω Two phase units in a three phase system reference source resistance is 0.4 Ω Two phase units in a split phase system reference source resistance is 0.24 Ω Three phase units reference source resistance is 0.24 Ω Where the **Power Factor** of the output is under 0.98 then the Xl 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 need to comply with the particular requirements set out in the testing notes for the technology under test.

4. Power quality – DC injection: 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.			P
Model: HNS8000TL			
Test power level	10%	55%	100%
Recorded value in Amps	0.060	0.059	0.061
as % of rated AC current	0.17%	0.16%	0.17%
Limit	0.25%	0.25%	0.25%
Model: HNS4000TL			
Test power level	10%	55%	100%
Recorded value in Amps	0.028	0.030	0.027
as % of rated AC current	0.16%	0.17%	0.15%
Limit	0.25%	0.25%	0.25%

5. Power Factor: 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**. 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.			P
Model: HNS8000TL			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9996	0.9995	0.9987
Power Factor Limit	>0.95	>0.95	>0.95
Model: HNS4000TL			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9995	0.9996	0.9988
Power Factor Limit	>0.95	>0.95	>0.95

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6. Protection – Frequency tests: These tests should be carried out in accordance with the Annex A.7.1.2.3.						P
Model: HNS8000TL						
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	47.48Hz	20.10s	47.7 Hz 30 s	No trip
U/F stage 2	47 Hz	0.5 s	46.98Hz	0.546s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F	52.0Hz	0.5s	52.02Hz	0.543s	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: These tests should be carried out in accordance with Annex A.7.1.2.2.						P
Model: HNS8000TL						
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)	2.5s	181.9V	2.512s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	1.14 pu (262.2 V)	1.0s	265.5V	1.088s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5s	276.7V	0.509s	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.						

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8. Protection – Loss of Mains test: These tests should be carried out in accordance with BS EN 62116. Annex A.7.1.2.4.						P
The following sub set of tests should be recorded in the following table.						
Model: HNS8000TL						
Test Power and imbalance	33% -5% Q	66% -5% Q	100% -5% P	33% +5% Q	66% +5% Q	100% +5% P
Trip time. Limit is 0.5s	68.80 ms	73.60 ms	86.80 ms	83.20 ms	76.00 ms	99.60 ms

Loss of Mains Protection, Vector Shift Stability test. This test should be carried out in accordance with Annex A.7.1.2.6.			P
Model: HNS8000TL			
Vector Shift	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.0 Hz	+50 degrees	No trip
Negative Vector Shift	50.0 Hz	- 50 degrees	No trip

Loss of Mains Protection, RoCoF Stability test: This test should be carried out in accordance with Annex A.7.1.2.6.			P
Model: HNS8000TL			
Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0 Hz to 51.0 Hz	+0.95 Hzs^{-1}	2.1 s	No trip
51.0 Hz to 49.0 Hz	-0.95 Hzs^{-1}	2.1 s	No trip

9. Limited Frequency Sensitive Mode – Over frequency test: The test should be carried out using the specific threshold frequency of 50.4 Hz and Droop less than 12.8% and greater than 8.5%. This test should be carried out in accordance with Annex A.7.1.3.					P
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.7.2.4.					Y/N
Alternatively, simulation results should be noted below:					
Model: HNS8000TL					
Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculate droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	7993.53	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	7896.73	50.45	-		-
Step c) 50.70 Hz ±0.10 Hz	7520.73	50.70	10.64		-
Step d) 51.15 Hz ±0.05 Hz	6780.51	51.15	10.03		-
Step e) 50.70 Hz ±0.10 Hz	7520.38	50.70	10.63		-
Step f) 50.45 Hz ±0.05 Hz	7948.05	50.45	-		-
Step g) 50.00 Hz ±0.01 Hz	7995.77	50.00	-		10%
Test sequence at **Registered Capacity** 40-60%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculate droop (%)	Primary Power Source	**Active Power** Gradient

Step a) 50.00 Hz ±0.01 Hz	4016.38	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	4017.02	50.45	-		-
Step c) 50.70 Hz ±0.10 Hz	3782.34	50.70	8.52		-
Step d) 51.15 Hz ±0.05 Hz	3417.96	51.15	9.34		-
Step e) 50.70 Hz ±0.10 Hz	3782.84	50.70	8.54		-
Step f) 50.45 Hz ±0.05 Hz	3900.00	50.45	-		-
Step g) 50.00 Hz ±0.01 Hz	4016.18	50.00	-		10%

10. Protection – Re-connection timer.					**P**
Model: HNS8000TL					
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.			
30 s	31 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

11. Fault level contribution: These tests shall be carried out in accordance with EREC G99 Annex A.7.1.5.		**P**
For Inverter output		
Model: HNS8000TL		
Time after fault	Volts	Amps
20ms	111.7 V	1.18 A
100ms	--	--
250ms	--	--
500ms	--	--
Time to trip	8.5 ms	In seconds

12. Self-Monitoring solid state switching: No specified test requirements. Refer to Annex A.7.1.7.	
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**
Additional comments.	
No.	