Test Verification of Conformity

Verification Number: 210403960SHA-V2

On the basis of the tests undertaken, the sample<s> of the below product have been found to comply with the requirements of the referenced specification<s>/standard<s> at the time the tests were carried out. This verification is part of the full test report<s> and should be read in conjunction with it <them>.

Applicant Name & Address:	Afore New Energy Technology (Shanghai)Co., Ltd. Build No.7, 333 Wanfang Road, Minhang District, Shanghai, China 201112
Product Description:	Grid-connected PV inverter
Ratings & Principle Characteristics:	See Appendix(Specifications table)
Models/Type References:	See Appendix(Specifications table)
Brand Name:	Afore
Relevant Standards:	VDE-AR-N 4105:2018 conjunction with DIN VDE V 0124-100 :2020
Verification Issuing Office Name & Address:	Intertek Testing Services Shanghai Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China
Date of Tests:	2021-04-29 to 2021-05-21
Test Report Number(s):	210403960SHA-002

Additional information in Appendix.

Signature

Name: Jonny Jing
Position: Manager
Date: 2021-05-21

APPENDIX: Test Verification of Conformity

This is an Appendix to Test Verification of Conformity Number: 210403960SHA-V2

Manufacturer: Same as applicant

Specifications table				
Model	HNS3000TL	HNS3600TL-1	HNS3600TL	HNS4000TL
Input:				
Vmax PV (Vdc)	600	600	600	600
Isc PV (absolute Max.) (A)	18 x 2	18	18 x 2	18 x 2
Number MPP trackers	2	1	2	2
Number input strings	1/1	1	1/1	1/1
Max. PV input current(A)	14 x 2	14	14 x 2	14 x 2
MPPT voltage range (Vdc)	70-550	70-550	70-550	70-550
Vdc range @ full power (Vdc)	110-550	265-550	130-550	145-550
Output				
Normal Voltage(V)	L/N/PE, 220Vac, 230Vac, 240Vac			
Frequency (Hz)	50 / 60			
Current (normal) (A)	13.1	15.7	15.7	17.4
Current (Max. continuous) (A)	15	17.5	17.5	20
Power rating (W)	3000	3600	3600	4000
Power Rating (VA)	3000	3600	3600	4000
Power factor /rated	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)
others				
Protective class	Class I			
Ingress protection (IP)	IP 65			
Temperature (℃)	-25℃ to +60℃ (up 45℃ derating)			
Inverter Isolation	Non-isolated			
Overvoltage category	OVC III (AC Main), OVC II (PV)			
Weight (kg)	12			
Dimensions (WxHxD) (mm)	340 x 345 x 170			

Specifications table				
Model	HNS5000TL	HNS6000TL	HNS7000TL	HNS8000TL
Input:				
Vmax PV (Vdc)	600	600	600	600
Isc PV (absolute Max.) (A)	18 x 2	18 x 2	18+35	18+35
Number MPP trackers	2	2	2	2
Number input strings	1/1	1/1	1/2	1/2
Max. PV input current(A)	14 x 2	14 x 2	13+26	13+26
MPPT voltage range (Vdc)	70-550	70-550	70-550	70-550
Vdc range @ full power (Vdc)	180-550	220-550	220-550	220-550
Output				
Normal Voltage(V)	L/N/PE, 220Vac, 230Vac, 240Vac			
Frequency (Hz)	50 / 60			
Current (normal) (A)	21.8	26.1	30.5	34.8
Current (Max. continuous) (A)	24	28.7	33.6	38.3
Power rating (W)	5000	6000	7000	8000
Power Rating (VA)	5000	6000	7000	8000
Power factor /rated	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)	1 (-0,8~+0,8 adjustable)
others				
Protective class	Class I			
Ingress protection (IP)	IP 65			
Temperature (℃)	-25℃ to +60℃ (up 45℃ derating)			
Inverter Isolation	Non-isolated			
Overvoltage category	OVC III (AC Main), OVC II (PV)			
Weight (kg)	12		17	
Dimensions (WxHxD) (mm)	340 x 345 x 170		510 x 370 x 167	

Annex E4: Verification of Conformity for power generation units

Verification of Conformity for power generation units	No: 210403960SHA-V2		
Manufacturer	Afore New Energy Technology (Shanghai)Co., Ltd. Build No.7, 333 Wanfang Road, Minhang District, Shanghai, China 201112		
Type power generation unit	Grid-connected PV inverter		
Model	HNS3000TL, HNS3600TL-1, HNS3600TL, HNS4000TL, HNS5000TL, HNS6000TL, HNS7000TL, HNS8000TL		
Assessment values	Max. active power PEmax (W)	3016	HNS3000TL
		8001	HNS8000TL
	Max. apparent power SEmax (VA)	3041	HNS3000TL
		8020	HNS8000TL
	Rated voltage	1/N/PE~ 230Vac	
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		
Firmware version	V06		
The above mentioned power generation unit meets the requirements of VDE-AR-N 4105.			

Annex E.5 Test report "Network interactions" for power generation units

Model: HNS3000TL

Extract from the test report on the certificate of units		210403960SHA-002		
Type of installation:	Grid-connected PV inverter		Manufacturer 's data	
Installation manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.		Type of installation: Grid-connected PV inverter	
			Power of normal output in nominal conditions):3000 W	
			Rating voltage:	230 V
Period of measurement:		From 2021-04-29 to 2021-05-21		
		Maximum active Power P_{Emax} 3016 W	Maximum reactive Power S_{Emax} 3041 VA	
		Switching actions		
		Switching on without specification (to the primary energy carrier)	k_i	0.148
		Most unfavorable case when switching between generator levels	k_i	0.149
		Switching on during nominal conditions (of the primary energy carrier)	k_i	0.144
		Switching off during normal output	k_i	0.311
		Worst value of all switching operations	k_{imax}	0.309
				The limit of k_{imax} is 1.0
Flicker		Angle of network impedance Ψ_k:	32°	
		Long-term flicker strength P_{lt}:	0.15	

Model: HNS3000TL

E.5 Test report "Network interactions" for power generation units

Harmonic-(for the PGU and PGS<3.68kVA/phase)				
Load current: 100 %				
Ordinal number	Current (%) L1	Current (%) L2	Current (%) L3	Limit (%)
0	0.015	-	-	0.5% I
1	--	-	-	--
2	0.239	-	-	1.08
3	1.185	-	-	2.3
4	0.060	-	-	0.43
5	0.519	-	-	1.14
6	0.051	-	-	0.30
7	0.173	-	-	0.77
8	0.058	-	-	0.23
9	0.200	-	-	0.40
10	0.123	-	-	0.184
11	0.253	-	-	0.33
12	0.093	-	-	0.153
13	0.215	-	-	0.21
14	0.091	-	-	0.131
15	0.344	-	-	0.15
16	0.074	-	-	0.115
17	0.084	-	-	0.132
18	0.038	-	-	0.102
19	0.163	-	-	0.118
20	0.065	-	-	0.092
21	0.107	-	-	0.107
22	0.038	-	-	0.084
23	0.040	-	-	0.098
24	0.038	-	-	0.077
25	0.077	-	-	0.09
26	0.054	-	-	0.071
27	0.049	-	-	0.083
28	0.050	-	-	0.066
29	0.051	-	-	0.078
30	0.036	-	-	0.061
31	0.054	-	-	0.073
32	0.040	-	-	0.058
33	0.036	-	-	0.068
34	0.049	-	-	0.054
35	0.062	-	-	0.064
36	0.030	-	-	0.051
37	0.040	-	-	0.061
38	0.034	-	-	0.048
39	0.033	-	-	0.058
40	0.043	-	-	0.046
THD	1.83	-	-	5
PWHD	-	-	-	22%

Annex E.7 Requirements to the Test Report on the NS protection

Model: HNS3000TL

Extract from the test report for the NS protection "Determination of electric properties"	210403960SHA-002

Test report NS Protection

Type of NS protection:	Integral	Further manufacturer instructions
Software version:	V06	
Manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.	
Period of measurement:	From 2021-04-29 to 2021-05-21	

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	288.0V	0.188 s
Rise-in-voltage protection U >	1.15 * U_n	264.8V	0.191 s
Voltage drop protection U <	0.8 * U_n	183.8V	2.990 s*
Voltage drop protection U <	0.45 * Un	103.3V	0.295 s
Frequency decrease protection f <	47.5Hz	*47.48Hz*	0.192 s
Frequency increase protection f >	51.5Hz	*51.52Hz*	0.196 s

[a] 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

* Longest disconnection of the rise-in-voltage protection as a moving 10-minute-average.

☒ **For integrated NS protection**

Assigned to power generation unit of type	Grid-connected PV inverter
Type integrated interface switch	Power Relay
Response time of interface switch for integrated NS protection	12ms

Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.

NOTE1: Un=230V

Annex E.5 Test report “Network interactions” for power generation units

Model: HNS8000TL

Extract from the test report on the certificate of units		210403960SHA-002		
Type of installation:	Grid-connected PV inverter		Manufacturer ‘s data	
Installation manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.		Type of installation: Grid-connected PV inverter	
			Power of normal output in nominal conditions):1000 W	
			Rating voltage:	230 V
Period of measurement:		From 2021-04-29 to 2021-05-21		
		Maximum active Power P_{Emax} 8001 W	Maximum reactive Power S_{Emax} 8020 VA	
		Switching actions		
		Switching on without specification (to the primary energy carrier)	k_i 0.15	The limit of k_{imax} is 1.0
		Most unfavorable case when switching between generator levels	k_i 0.15	
		Switching on during nominal conditions (of the primary energy carrier)	k_i 0.14	
		Switching off during normal output	k_i 0.31	
		Worst value of all switching operations	k_{imax} 0.31	
Flicker		Angle of network impedance Ψ_k:	32°	
		Long-term flicker strength P_{lt}:	0.17	

Model: HNS8000TL

E.5 Test report "Network interactions" for power generation units

Harmonic-(for the PGU and PGS>3.68kVA/phase)				
Load current: 100 %				
Ordinal number	Current (%) L1	Current (%) L2	Current (%) L3	Limit (%)
0	0.014	-	-	0.5% I
1	--	-	-	--
2	0.284	-	-	8%
3	1.967	-	-	Not stated
4	0.077	-	-	4%
5	0.786	-	-	10.7%
6	0.043	-	-	2.67%
7	0.369	-	-	7.2%
8	0.042	-	-	2%
9	0.181	-	-	Not stated
10	0.046	-	-	1.6%
11	0.176	-	-	3.1%
12	0.088	-	-	1.33%
13	0.184	-	-	2%
14	0.054	-	-	---
15	0.125	-	-	---
16	0.062	-	-	---
17	0.131	-	-	---
18	0.038	-	-	---
19	0.093	-	-	---
20	0.045	-	-	---
21	0.035	-	-	---
22	0.030	-	-	---
23	0.032	-	-	---
24	0.036	-	-	---
25	0.084	-	-	---
26	0.027	-	-	---
27	0.035	-	-	---
28	0.043	-	-	---
29	0.042	-	-	---
30	0.021	-	-	---
31	0.036	-	-	---
32	0.022	-	-	---
33	0.023	-	-	---
34	0.030	-	-	---
35	0.058	-	-	---
36	0.034	-	-	---
37	0.035	-	-	---
38	0.022	-	-	---
39	0.069	-	-	---
40	0.046	-	-	---
THD	2.307	-	-	13%
PWHD	0.014	-	-	22%

Annex E.7 Requirements to the Test Report on the NS protection

Model: HNS8000TL

Extract from the test report for the NS protection "Determination of electric properties"		210403960SHA-002
Test report NS Protection		
Type of NS protection:	Integral	Further manufacturer instructions
Software version:	V06	
Manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.	
Period of measurement:	From 2021-04-29 to 2021-05-21	

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	288.0V	0.188 s
Rise-in-voltage protection U >	1.15 * U_n	264.8V	0.191 s
Voltage drop protection U <	0.8 * U_n	183.8V	2.990 s*
Voltage drop protection U <	0.45 * Un	103.3V	0.295 s
Frequency decrease protection f <	47.5Hz	*47.48Hz*	0.192 s
Frequency increase protection f >	51.5Hz	*51.52Hz*	0.196 s

[a] 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

* Longest disconnection of the rise-in-voltage protection as a moving 10-minute-average.

☒ **For integrated NS protection**

Assigned to power generation unit of type	Grid-connected PV inverter
Type integrated interface switch	Power Relay
Response time of interface switch for integrated NS protection	12ms

Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.

NOTE1: Un=230V

Signature

Name: Jonny Jing
Position: Manager
Date: 2021-05-21