Test Verification of Conformity

Verification Number: 200601510SHA-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 201114
Product Description:	PV Grid interconnected 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:	2020-06-01 to 2020-07-12
Test Report Number(s):	200601510SHA-002

Additional information in Appendix.

Signature

Name: Jonny Jing
Position: Manager
Date: 2020-11-23

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APPENDIX: Test Verification of Conformity

This is an Appendix to Test Verification of Conformity Number: 200601510SHA-V2

Manufacturer: Same as applicant

Specifications table				
Model	BNT036KTL	BNT040KTL	BNT050KTL	BNT060KTL
Input:				
Vmax PV (Vdc)	1000	1000	1000	1000
Isc PV (absolute Max.) (A)	45 x 2	50 x 2	45 x 3	50 x 3
Number MPP trackers	2	2	3	3
Number input strings	4/4	4/4	4/4/4	4/4/4
Max. PV input current(A)	36 x 2	40 x 2	36 x 3	40 x 3
MPPT voltage range (Vdc)	200-950	200-950	200-950	200-950
Vdc range @ full power (Vdc)	500-850	500-850	500-950	500-950
Output				
Normal Voltage(V)	3 ϕ /N/PE 400Vac			
Frequency (Hz)	50 Hz			
Current (normal) (A)	52.2	58	72.5	87
Current (Max. continuous) (A)	56	61	75	90
Power rating (W)	36000	40000	50000	60000
Power Rating (VA)	36000	40000	50000	60000
Power factor /rated	1(-0.8~0.8)	1(-0.8~0.8)	1(-0.8~0.8)	1(-0.8~0.8)
others				
Protective class	Class I			
Ingress protection (IP)	IP 65			
Temperature (℃)	-25℃ to +60℃ (up 45℃ derating)			
Inverter Isolation	☒Non-isolated ☐High frequency isolated			
Overvoltage category	OVC III (AC Main), OVC II (PV)			
Weight (kg)	66			
Dimensions (WxHxD) (mm)	630 x 850 x 306			

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Annex E4: Verification of Conformity for power generation units

Verification of Conformity for power generation units	No: **200601510SHA-V2**		
Manufacturer	Afore New Energy Technology (Shanghai)Co., Ltd. Build No.7, 333 Wanfang Road, Minhang District, Shanghai, China 201114		
Type power generation unit	PV Grid interconnected inverter		
Model	BNT036KTL, BNT040KTL, BNT050KTL, BNT060KTL		
Assessment values	**Max.** active power PEmax (W)	36109	BNT036KTL
		40015	BNT040KTL
		50000	BNT050KTL
		60084	BNT060KTL
	Max. apparent power SEmax (VA)	36283	BNT036KTL
		40377	BNT040KTL
		50300	BNT050KTL
		60181	BNT060KTL
	Rated voltage	3/N/PE~ 400Vac	
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		
Finnware version	DSP TP2.03		
The above mentioned power generation unit meets the requirements of VDE-AR-N 4105.			

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Annex E.5 Test report "Network interactions" for power generation units
Model: BNT036KTL

Extract from the test report on the certificate of units		200601510SHA-002				
Type of installation:	PV Grid-interactive inverter		Manufacturer 's data			
Installation manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.		Type of installation: PV Grid interconnected inverter			
			Power of normal output in nominal conditions):36000 W			
			Rating voltage: 400 V			
Period of measurement:		From 2020-06-01 to 2020-07-12				
		Maximum active Power P_{Emax} 36109 W	Maximum reactive Power S_{Emax} 36283 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	0.15		
		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}:	0.15, 0.19, 0.25			

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Model: BNT036KTL

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	0.080	0.200	0.050	0.5% I
1	--	--	--	--
2	0.498	0.579	0.636	8%
3	0.241	0.105	0.226	Not stated
4	0.124	0.160	0.104	4%
5	1.205	1.019	1.147	10.7%
6	0.080	0.099	0.100	2.67%
7	0.403	0.421	0.340	7.2%
8	0.053	0.083	0.081	2%
9	0.070	0.046	0.086	Not stated
10	0.090	0.072	0.048	1.6%
11	0.139	0.141	0.114	3.1%
12	0.038	0.042	0.055	1.33%
13	0.196	0.143	0.120	2%
14	0.041	0.044	0.034	-
15	0.055	0.050	0.090	-
16	0.032	0.042	0.036	-
17	0.121	0.197	0.189	-
18	0.039	0.045	0.044	-
19	0.199	0.156	0.184	-
20	0.048	0.038	0.041	-
21	0.050	0.046	0.060	-
22	0.045	0.041	0.042	-
23	0.140	0.156	0.087	-
24	0.039	0.041	0.040	-
25	0.090	0.067	0.075	-
26	0.025	0.027	0.026	-
27	0.026	0.022	0.026	-
28	0.019	0.017	0.018	-
29	0.030	0.037	0.039	-
30	0.014	0.014	0.013	-
31	0.026	0.029	0.036	-
32	0.011	0.010	0.012	-
33	0.010	0.008	0.013	-
34	0.008	0.009	0.008	-
35	0.029	0.027	0.036	-
36	0.007	0.008	0.008	-
37	0.033	0.037	0.046	-
38	0.007	0.008	0.006	-
39	0.008	0.007	0.019	-
40	0.007	0.009	0.007	-
THD	1.646%	1.522%	1.650%	13%
PWHD	0.015%	0.015%	0.015%	22%

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Annex E.7 Requirements to the Test Report on the NS protection
Model: BNT036KTL

Extract from the test report for the NS protection "Determination of electric properties"	200601510SHA-002

Test report NS Protection

Type of NS protection:	Integral	Further manufacturer instructions
Software version:	DSP TP 2.03	
Manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.	
Period of measurement:	From 2020-06-01 to 2020-07-12	

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	501V	165 ms
Rise-in-voltage protection U >	1.15 * U_n	461V	181 ms
Voltage drop protection U <	0.8 * U_n	322V	2 s*
Voltage drop protection U <	0.45 * Un	181V	246 ms
Frequency decrease protection f <	47.5Hz	*47.48Hz*	185 ms
Frequency increase protection f >	51.5Hz	*51.51Hz*	183 ms

[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	PV Grid-interactive 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=400V

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Annex E.5 Test report “Network interactions” for power generation units
Model: BNT040KTL

Extract from the test report on the certificate of units		200601510SHA-002				
Type of installation:	PV Grid-interactive inverter		Manufacturer ‘s data			
Installation manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.		Type of installation: PV Grid interconnected inverter			
			Power of normal output in nominal conditions):40000 W			
			Rating voltage: 400 V			
Period of measurement:		From 2020-06-01 to 2020-07-12				
		Maximum active Power P_{Emax} 40015 W	Maximum reactive Power S_{Emax} 40377 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	0.15		
		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}:	0.15, 0.19, 0.25			

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Model: BNT040KTL

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	0.140	0.130	0.130	0.5% I
1	--	--	--	--
2	0.263	0.384	0.643	8%
3	0.176	0.099	0.130	Not stated
4	0.201	0.211	0.212	4%
5	0.579	0.592	0.543	10.7%
6	0.070	0.073	0.078	2.67%
7	0.804	0.811	0.827	7.2%
8	0.060	0.053	0.083	2%
9	0.066	0.074	0.086	Not stated
10	0.066	0.055	0.091	1.6%
11	0.799	0.767	0.755	3.1%
12	0.055	0.069	0.077	1.33%
13	1.310	1.835	1.509	2%
14	0.215	0.127	0.206	-
15	0.205	0.152	0.217	-
16	0.062	0.055	0.059	-
17	0.158	0.170	0.172	-
18	0.021	0.020	0.026	-
19	0.052	0.054	0.060	-
20	0.018	0.016	0.022	-
21	0.015	0.014	0.018	-
22	0.012	0.012	0.013	-
23	0.036	0.040	0.039	-
24	0.010	0.008	0.010	-
25	0.044	0.048	0.047	-
26	0.009	0.007	0.008	-
27	0.009	0.007	0.008	-
28	0.010	0.010	0.008	-
29	0.044	0.046	0.045	-
30	0.009	0.008	0.009	-
31	0.046	0.049	0.046	-
32	0.008	0.008	0.009	-
33	0.008	0.008	0.007	-
34	0.008	0.007	0.007	-
35	0.052	0.054	0.055	-
36	0.007	0.007	0.009	-
37	0.047	0.051	0.047	-
38	0.009	0.009	0.006	-
39	0.009	0.008	0.007	-
40	0.010	0.008	0.008	-
THD	2.211	2.629	2.395	13%
PWHD	0.015	0.013	0.015	22%

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Annex E.7 Requirements to the Test Report on the NS protection
Model: BNT040KTL

Extract from the test report for the NS protection "Determination of electric properties"	200601510SHA-002

Test report NS Protection

Type of NS protection:	Integral	Further manufacturer instructions
Software version:	DSP TP 2.03	
Manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.	
Period of measurement:	From 2020-06-01 to 2020-07-12	

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	501V	165 ms
Rise-in-voltage protection U >	1.15 * U_n	461V	181 ms
Voltage drop protection U <	0.8 * U_n	322V	2 s*
Voltage drop protection U <	0.45 * Un	181V	246 ms
Frequency decrease protection f <	47.5Hz	*47.48Hz*	185 ms
Frequency increase protection f >	51.5Hz	*51.51Hz*	183 ms

[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	PV Grid-interactive 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=400V

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Annex E.5 Test report "Network interactions" for power generation units
Model: BNT050KTL

Extract from the test report on the certificate of units		200601510SHA-002				
Type of installation:	PV Grid-interactive inverter		Manufacturer 's data			
Installation manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.		Type of installation: PV Grid interconnected inverter			
			Power of normal output in nominal conditions):50000 W			
			Rating voltage: 400 V			
Period of measurement:		From 2020-06-01 to 2020-07-12				
		Maximum active Power P_{Emax} 50000 W	Maximum reactive Power S_{Emax} 50300 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	0.15		
		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}:	0.15, 0.19, 0.25			

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Model: BNT050KTL

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	0.120	0.080	0.060	0.5% I
1	--	--	--	--
2	0.336	0.652	0.510	8%
3	0.148	0.131	0.178	Not stated
4	0.106	0.158	0.107	4%
5	0.995	0.778	0.989	10.7%
6	0.074	0.085	0.087	2.67%
7	0.381	0.420	0.331	7.2%
8	0.054	0.071	0.063	2%
9	0.075	0.048	0.085	Not stated
10	0.066	0.066	0.044	1.6%
11	0.043	0.076	0.061	3.1%
12	0.043	0.047	0.041	1.33%
13	0.092	0.070	0.073	2%
14	0.046	0.040	0.030	-
15	0.030	0.032	0.039	-
16	0.030	0.028	0.025	-
17	0.027	0.034	0.030	-
18	0.025	0.023	0.024	-
19	0.051	0.037	0.053	-
20	0.024	0.023	0.023	-
21	0.036	0.042	0.066	-
22	0.031	0.025	0.024	-
23	0.042	0.039	0.067	-
24	0.028	0.025	0.024	-
25	0.067	0.078	0.066	-
26	0.024	0.025	0.024	-
27	0.029	0.021	0.032	-
28	0.017	0.018	0.017	-
29	0.031	0.037	0.035	-
30	0.012	0.013	0.012	-
31	0.035	0.036	0.033	-
32	0.009	0.009	0.009	-
33	0.009	0.009	0.008	-
34	0.008	0.007	0.009	-
35	0.031	0.029	0.033	-
36	0.005	0.006	0.005	-
37	0.021	0.026	0.028	-
38	0.005	0.004	0.004	-
39	0.007	0.006	0.012	-
40	0.004	0.004	0.005	-
THD	1.348	1.437	1.471	13%
PWHD	0.007	0.007	0.008	22%

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Annex E.7 Requirements to the Test Report on the NS protection
Model: BNT050KTL

Extract from the test report for the NS protection "Determination of electric properties"	200601510SHA-002

Test report NS Protection

Type of NS protection:	Integral	Further manufacturer instructions
Software version:	DSP TP 2.03	
Manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.	
Period of measurement:	From 2020-06-01 to 2020-07-12	

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	501V	165 ms
Rise-in-voltage protection U >	1.15 * U_n	461V	181 ms
Voltage drop protection U <	0.8 * U_n	322V	2 s*
Voltage drop protection U <	0.45 * Un	181V	246 ms
Frequency decrease protection f <	47.5Hz	*47.48Hz*	185 ms
Frequency increase protection f >	51.5Hz	*51.51Hz*	183 ms

[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	PV Grid-interactive 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=400V

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Annex E.5 Test report “Network interactions” for power generation units
Model: BNT060KTL

Extract from the test report on the certificate of units		200601510SHA-002			
Type of installation:	Grid-connected Micro Inverter	Manufacturer ‘s data			
Installation manufacturer:	Afore New Energy Technology (Shanghai) Co., Ltd.	Type of installation: PV Grid interconnected inverter			
		Power of normal output in nominal conditions): 60000W			
		Rating voltage: 400 V			
Period of measurement:	From 2020-06-01 to 2020-07-12				
Maximum active Power P_{Emax} 60084 W		Maximum reactive Power S_{Emax} 600181 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	0.15		
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}:	0.15, 0.19, 0.25			

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Model: BNT060KTL

F.3 Requirements to the Test Report on Generation Units

Harmonic-(for the PGU and PGS≤3.68kVA/phase)				
Load current: 100 %				
Ordinal number	Current (%) L1	Current (%) L2	Current (%) L3	Limit (%)
0	0.070	0.150	0.190	0.5% I
1	--	--	--	--
2	0.398	0.569	0.571	8%
3	0.203	0.131	0.197	Not stated
4	0.127	0.152	0.105	4%
5	1.001	0.830	0.969	10.7%
6	0.090	0.081	0.092	2.67%
7	0.353	0.364	0.303	7.2%
8	0.055	0.072	0.066	2%
9	0.062	0.053	0.074	Not stated
10	0.083	0.065	0.046	1.6%
11	0.105	0.103	0.091	3.1%
12	0.038	0.044	0.055	1.33%
13	0.135	0.111	0.067	2%
14	0.037	0.041	0.034	-
15	0.052	0.039	0.080	-
16	0.033	0.039	0.031	-
17	0.084	0.152	0.147	-
18	0.034	0.037	0.040	-
19	0.145	0.116	0.141	-
20	0.046	0.038	0.037	-
21	0.040	0.043	0.046	-
22	0.043	0.036	0.039	-
23	0.089	0.095	0.043	-
24	0.039	0.036	0.041	-
25	0.120	0.081	0.107	-
26	0.029	0.028	0.030	-
27	0.027	0.027	0.024	-
28	0.021	0.018	0.022	-
29	0.030	0.033	0.046	-
30	0.014	0.014	0.013	-
31	0.015	0.024	0.028	-
32	0.011	0.010	0.011	-
33	0.009	0.008	0.009	-
34	0.008	0.008	0.009	-
35	0.029	0.025	0.032	-
36	0.007	0.006	0.006	-
37	0.023	0.030	0.033	-
38	0.007	0.006	0.006	-
39	0.007	0.006	0.014	-
40	0.006	0.006	0.006	-
THD	1.428%	1.376%	1.458%	13%
PWHD	0.012%	0.012%	0.013%	22%

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Annex E.7 Requirements to the Test Report on the NS protection
Model: BNT060KTL

Extract from the test report for the NS protection "Determination of electric properties"			200601510SHA-002	
Test report NS Protection				
Type of NS protection:	Integral		Further manufacturer instructions	
Software version:	DSP TP 2.03			
Manufacturer:	Afore New Energy Technology(Shanghai) Co., Ltd.			
Period of measurement:	From 2020-06-01 to 2020-07-12			

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	501V	165 ms
Rise-in-voltage protection U >	1.15 * U_n	461V	181 ms
Voltage drop protection U <	0.8 * U_n	322V	2 s*
Voltage drop protection U <	0.45 * Un	181V	246 ms
Frequency decrease protection f <	47.5Hz	*47.48Hz*	185 ms
Frequency increase protection f >	51.5Hz	*51.51Hz*	183 ms

[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	PV Grid-interactive 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=400V	

Signature

Name: Jonny Jing
Position: Manager
Date: 2020-11-23

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