Sungrow Power Supply Co., Ltd.
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SUNGROW

Public

Harmonic Test Report

IEC 61400-21:2008 Current harmonics, Interharmonics and Higher frequency components

TYPE TEST SHEET

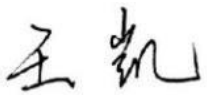
This Type Test sheet shall be used to record the results of the type testing of Generating Unit				
Type Tested reference number			SG250HX	
Generating Unit technology			Grid-connected PV Inverter	
Test time			2021/1/10	
System supplier name			Sungrow Power Supply Co., Ltd.	
Address			No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P.R. China	
Tel	+86 551 65327834		Fax	+86 551 6532 7800
E:mail	info@sungrow.cn		Web site	www.sungrowpower.com
Maximum export capacity, use separate sheet if more than one connection option.		N/A	kW single phase, single, split or three phase system	
		250	kW three phase	
		N/A	kW two phases in three phase system	
		N/A	kW two phases split phase system	
Compiled by			On behalf of	Sungrow Power Supply Co., Ltd.
Approved by				
Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate. Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.				

Table 1-Current distortion limits

Odd harmonics	Distortion limit
3rd through 9th	Less than 4.0%
11th through 15th	Less than 2.0%
17th through 21st	Less than 1.5%
23rd through 33rd	Less than 0.6%
Even harmonics	**Distortion limit**
2rd through 8th	Less than 1.0%
10th through 32nd	Less than 0.5%

NOTE Testing harmonics is very problematic, since voltage distortion may feed to enhanced current distortion. The harmonic current injection should be exclusive of any harmonic currents due to harmonic voltage distortion present in the utility grid without the PV system connected. Type tested inverters meeting the above requirements should be deemed to comply without further testing.

Low levels of current and voltage harmonics are desirable; the higher harmonic levels increase the potential for adverse effects on connected equipment
Acceptable levels of harmonic voltage and current depend upon distribution system characteristics, type of service, connected loads/apparatus, and established utility practice. Total harmonic current distortion shall be less than 5% at rated inverter output. Each individual harmonic shall be limited to the percentages listed in Table 1.
Even harmonics in these ranges shall be less than 25% of the lower odd harmonic limits listed.

IEC61400-21:2008 Item6.4 Current harmonics, Interharmonics and Higher frequency components regulation as below:

The emission of current harmonics, interharmonics and higher frequency components during continuous operation shall be stated (see Note).

The values of the individual current components (harmonics, interharmonics and higher frequency components) and the total harmonic current distortion shall be given in tables in percentage of In and for operation of the wind turbine within the active power bins 0, 10, 20, … , 100 % of Pn. 0, 10, 20, … , 100 % are the bin midpoints.

The individual harmonic current components shall be specified as subgrouped values for frequencies up to 50 times the fundamental grid frequency, and the total harmonic current distortion shall be stated as derived from these.

The Interharmonic current components shall be specified as subgrouped values for frequencies up to 2 kHz in accordance to Annex A of IEC 61000-4-7:2002.

The higher frequency current components shall be specified as subgrouped values for frequencies between 2 kHz and 9 kHz in accordance to Annex B of IEC 61000-4-7:2002.

The arithmetic average is formed over the 10 minutes record for each harmonic, interharmonic and higher frequency component of the current.

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Harmonics:

Pbin (%)	0	10	20	30	40	50	60	70	80	90	100	110	Max
H	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	
2	0.015	0.020	0.027	0.029	0.030	0.031	0.039	0.041	0.040	0.042	0.038	0.046	0.046
3	0.048	0.049	0.056	0.050	0.050	0.053	0.052	0.054	0.060	0.066	0.080	0.107	0.107
4	0.010	0.009	0.009	0.007	0.009	0.010	0.012	0.012	0.013	0.016	0.014	0.015	0.016
5	0.589	0.471	0.504	0.324	0.275	0.290	0.321	0.348	0.234	0.253	0.293	0.323	0.589
6	0.009	0.009	0.010	0.008	0.012	0.013	0.015	0.014	0.012	0.010	0.007	0.008	0.015
7	0.738	0.733	0.832	0.811	0.698	0.578	0.476	0.426	0.427	0.411	0.407	0.417	0.832
8	0.007	0.010	0.009	0.010	0.012	0.012	0.013	0.013	0.011	0.011	0.010	0.011	0.013
9	0.022	0.025	0.026	0.021	0.025	0.025	0.024	0.023	0.019	0.016	0.015	0.018	0.026
10	0.008	0.011	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.007	0.006	0.006	0.011
11	0.243	0.357	0.178	0.254	0.383	0.354	0.305	0.256	0.170	0.127	0.095	0.073	0.383
12	0.008	0.007	0.007	0.006	0.007	0.007	0.008	0.008	0.007	0.006	0.006	0.006	0.008
13	0.118	0.267	0.179	0.120	0.205	0.210	0.189	0.163	0.124	0.086	0.058	0.041	0.267
14	0.007	0.007	0.007	0.006	0.007	0.008	0.008	0.008	0.007	0.006	0.006	0.006	0.008
15	0.016	0.016	0.018	0.017	0.017	0.017	0.014	0.014	0.018	0.018	0.019	0.020	0.020
16	0.011	0.007	0.008	0.006	0.007	0.008	0.008	0.007	0.006	0.006	0.005	0.005	0.011
17	0.217	0.126	0.259	0.149	0.146	0.189	0.192	0.174	0.152	0.125	0.101	0.086	0.259
18	0.007	0.006	0.006	0.006	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.007
19	0.130	0.122	0.191	0.144	0.113	0.154	0.176	0.165	0.137	0.114	0.096	0.077	0.191
20	0.006	0.007	0.007	0.006	0.008	0.008	0.007	0.008	0.007	0.006	0.005	0.005	0.008
21	0.012	0.012	0.014	0.013	0.014	0.014	0.012	0.014	0.013	0.012	0.011	0.012	0.014
22	0.009	0.006	0.006	0.006	0.007	0.008	0.007	0.007	0.006	0.005	0.005	0.005	0.009
23	0.060	0.100	0.054	0.099	0.066	0.052	0.088	0.089	0.074	0.062	0.054	0.047	0.100
24	0.005	0.006	0.006	0.006	0.007	0.007	0.007	0.006	0.006	0.005	0.005	0.005	0.007
25	0.090	0.065	0.064	0.083	0.069	0.039	0.069	0.075	0.068	0.058	0.053	0.048	0.090
26	0.008	0.007	0.006	0.006	0.006	0.007	0.007	0.007	0.006	0.005	0.005	0.005	0.008

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Pbin (%)	0	10	20	30	40	50	60	70	80	90	100	110	Max
H	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	
27	0.011	0.010	0.010	0.010	0.011	0.011	0.010	0.011	0.010	0.008	0.007	0.008	0.011
28	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.005	0.005	0.004	0.003	0.004	0.006
29	0.062	0.058	0.067	0.030	0.063	0.028	0.036	0.050	0.044	0.034	0.031	0.030	0.067
30	0.004	0.005	0.004	0.004	0.004	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.005
31	0.035	0.059	0.045	0.021	0.051	0.030	0.024	0.040	0.040	0.034	0.033	0.034	0.059
32	0.006	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.006
33	0.009	0.010	0.008	0.008	0.008	0.009	0.008	0.009	0.008	0.006	0.005	0.006	0.010
34	0.005	0.006	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.004	0.006
35	0.051	0.031	0.015	0.021	0.023	0.020	0.006	0.015	0.023	0.021	0.020	0.021	0.051
36	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004
37	0.025	0.032	0.024	0.023	0.021	0.020	0.009	0.015	0.022	0.020	0.018	0.018	0.032
38	0.005	0.004	0.003	0.003	0.003	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.005
39	0.008	0.007	0.006	0.006	0.006	0.006	0.006	0.007	0.006	0.005	0.004	0.004	0.008
40	0.004	0.003	0.003	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.004
41	0.029	0.022	0.023	0.018	0.013	0.015	0.008	0.010	0.015	0.016	0.013	0.012	0.029
42	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
43	0.017	0.010	0.015	0.012	0.008	0.010	0.007	0.007	0.012	0.015	0.015	0.014	0.017
44	0.004	0.002	0.003	0.003	0.003	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.004
45	0.005	0.004	0.005	0.005	0.005	0.005	0.005	0.004	0.005	0.004	0.004	0.004	0.005
46	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
47	0.014	0.008	0.009	0.006	0.009	0.008	0.006	0.006	0.010	0.012	0.013	0.012	0.014
48	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002
49	0.016	0.014	0.011	0.008	0.011	0.008	0.008	0.007	0.007	0.007	0.006	0.005	0.016
50	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002
THC (%)	1.027	1.009	1.065	0.954	0.899	0.813	0.740	0.691	0.588	0.552	0.550	0.567	1.065

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InterHarmonics

Pbin (%)	0	10	20	30	40	50	60	70	80	90	100	110	Max
f (Hz)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	
75	0.013	0.013	0.017	0.015	0.018	0.019	0.021	0.022	0.023	0.022	0.022	0.024	0.024
125	0.011	0.011	0.014	0.012	0.014	0.015	0.015	0.015	0.017	0.016	0.016	0.017	0.017
175	0.011	0.011	0.013	0.011	0.013	0.013	0.014	0.013	0.014	0.013	0.013	0.014	0.014
225	0.011	0.011	0.013	0.012	0.014	0.014	0.015	0.014	0.015	0.014	0.013	0.014	0.015
275	0.012	0.012	0.013	0.012	0.013	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.013
325	0.011	0.012	0.013	0.012	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.013	0.013
375	0.010	0.011	0.012	0.011	0.012	0.012	0.012	0.012	0.012	0.011	0.011	0.012	0.012
425	0.010	0.011	0.012	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.011	0.012	0.012
475	0.011	0.011	0.012	0.011	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.013
525	0.011	0.011	0.012	0.011	0.013	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.013
575	0.010	0.011	0.012	0.010	0.012	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.012
625	0.010	0.011	0.012	0.011	0.012	0.012	0.012	0.012	0.012	0.011	0.011	0.012	0.012
675	0.010	0.010	0.011	0.010	0.011	0.012	0.011	0.011	0.012	0.011	0.011	0.011	0.012
725	0.010	0.010	0.011	0.010	0.011	0.012	0.011	0.011	0.011	0.011	0.010	0.011	0.012
775	0.010	0.010	0.012	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.011	0.012	0.012
825	0.010	0.009	0.011	0.010	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.011	0.011
875	0.009	0.009	0.011	0.009	0.010	0.011	0.011	0.011	0.011	0.010	0.010	0.010	0.011
925	0.009	0.009	0.010	0.009	0.010	0.011	0.010	0.011	0.011	0.010	0.010	0.010	0.011
975	0.009	0.009	0.010	0.009	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.011	0.011
1025	0.008	0.008	0.010	0.008	0.010	0.010	0.010	0.010	0.010	0.009	0.009	0.009	0.010
1075	0.008	0.008	0.009	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
1125	0.008	0.008	0.009	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.009	0.009
1175	0.008	0.007	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.008	0.008	0.008	0.009
1225	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
1275	0.007	0.007	0.008	0.007	0.008	0.009	0.009	0.009	0.009	0.008	0.008	0.008	0.009

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Pbin (%)	0	10	20	30	40	50	60	70	80	90	100	110	Max
f (Hz)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	
1325	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.008
1375	0.007	0.006	0.007	0.006	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
1425	0.007	0.006	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.007	0.007
1475	0.007	0.007	0.006	0.006	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.007
1525	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
1575	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
1625	0.006	0.006	0.006	0.005	0.006	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.006
1675	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006
1725	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006
1775	0.005	0.005	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
1825	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004	0.004	0.004	0.005
1875	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.004	0.004	0.004	0.005
1925	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005
1975	0.004	0.003	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

Higher frequency components:

Pbin (%)	0	10	20	30	40	50	60	70	80	90	100	110	Max
f (kHz)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	
2.1	0.035	0.026	0.028	0.024	0.017	0.020	0.014	0.015	0.021	0.023	0.022	0.020	0.035
2.3	0.017	0.011	0.012	0.011	0.012	0.012	0.010	0.010	0.013	0.015	0.015	0.015	0.017
2.5	0.018	0.015	0.013	0.010	0.012	0.010	0.010	0.009	0.009	0.008	0.008	0.008	0.018
2.7	0.012	0.012	0.014	0.010	0.012	0.010	0.010	0.010	0.010	0.009	0.009	0.009	0.014
2.9	0.008	0.008	0.009	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.009
3.1	0.005	0.004	0.005	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005
3.3	0.003	0.003	0.005	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.005
3.5	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
3.7	0.001	0.001	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.002
3.9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.3	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.5	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.7	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
5.1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
5.3	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004
5.5	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004
5.7	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004
5.9	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003
6.1	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003
6.3	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003
6.5	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003
6.7	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.003
6.9	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.003

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Pbin (%)	0	10	20	30	40	50	60	70	80	90	100	110	Max
f (kHz)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	Ih(%)	
7.1	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.003
7.3	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003
7.5	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003
7.7	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003
7.9	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003
8.1	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003
8.3	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003	0.003	0.003	0.003	0.004	0.003
8.5	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.003
8.7	0.002	0.003	0.003	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	0.004
8.9	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.005	0.004

Additional comments
NA