广州三晶电气股份有限公司
Guangzhou Sanjing Electric Co.,Ltd.
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Add: SAJ Innovation Park, No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China.

Certificate EN 50549-1:2019 with Ireland deviations

European Standard

Manufacturer	Guangzhou Sanjing Electric Co., Ltd.
Address	No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China

Product Name	PV Grid-connected inverter					
Product Type	R5-0.7K-S1	R5-1K-S1	R5-1.5K-S1	R5-2K-S1	R5-2.5K-S1	R5-3K-S1
Max. AC Current [A]	3.5	5.0	7.5	10.0	12.5	15.0
Maximum Apparent Power [VA]	770	1100	1650	2200	2750	3300
Generating Unit technology	Single phase, transformerless, PV Grid-connected inverter					
Type Tested	Base on requirements EN 50549-1:2019					
Test Location	Guangzhou Sanjing Electric Co., Ltd. No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China					
Test Date	2021-7-15 to 2021-7-18					
Compliant to	-Requirements to Type A Generation Unit. -Commistion Regulation (EU) 2016/631 (NC RfG).					

Date: 2021.7.19 Signature:

Type Test Verification Report

Models R5-0.7K-S1, R5-1K-S1, R5-1.5K-S1, R5-2K-S1, R5-2.5K-S1 and R5-3K-S1 have the same structure, software logic and hardware structure , Except for the different model names, all tests are performed in R5-3K-S1.

Power Quality – Harmonics: These tests should be carried out as specified in EN 61000-3-3. The chosen test should be undertaken with a fixed source of energy at two power levels:

a) between 45 and 55%, b) at 100% of Registered Capacity.

Micro-generator rating per phase (rpp)		3	kW			
Harmonic	At 45-55% of **Registered Capacity**		100% of **Registered Capacity**			
	Measured Value MV in Amps	--	Measured Value MV in Amps	--	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.060	--	0.113	--	1.080	
3	0.140	--	0.649	--	2.300	
4	0.006	--	0.034	--	0.430	
5	0.078	--	0.396	--	1.140	
6	0.010	--	0.040	--	0.300	
7	0.065	--	0.212	--	0.770	
8	0.007	--	0.020	--	0.230	
9	0.061	--	0.153	--	0.400	
10	0.005	--	0.012	--	0.184	
11	0.043	--	0.101	--	0.330	
12	0.005	--	0.014	--	0.153	
13	0.038	--	0.078	--	0.210	
14	0.006	--	0.006	--	0.131	
15	0.032	--	0.050	--	0.150	
16	0.002	--	0.010	--	0.115	
17	0.022	--	0.048	--	0.132	

18	0.010	--	0.012	--	0.102	
19	0.018	--	0.030	--	0.118	
20	0.019	--	0.015	--	0.092	
21	0.023	--	0.037	--	0.107	0.160
22	0.008	--	0.018	--	0.084	
23	0.012	--	0.027	--	0.098	0.147
24	0.004	--	0.008	--	0.077	
25	0.012	--	0.016	--	0.090	0.135
26	0.008	--	0.008	--	0.071	
27	0.027	--	0.008	--	0.083	0.124
28	0.008	--	0.003	--	0.066	
29	0.020	--	0.016	--	0.078	0.117
30	0.007	--	0.010	--	0.061	
31	0.019	--	0.020	--	0.073	0.109
32	0.001	--	0.014	--	0.058	
33	0.017	--	0.026	--	0.068	0.102
34	0.013	--	0.009	--	0.054	
35	0.011	--	0.016	--	0.064	0.096
36	0.011	--	0.010	--	0.051	
37	0.014	--	0.022	--	0.061	0.091
38	0.005	--	0.009	--	0.048	
39	0.013	--	0.014	--	0.058	0.087
40	0.004	--	0.010	--	0.046	

Power Quality – Voltage fluctuations and Flicker:

Element	2				
Volt Range	300 V/50Hz	Element2	Judgement	Pass	
Un (U2)	229.593V	Total	Judgement	Pass	
Freq (U2)	50.003Hz	(Element1,2,3)			
Dmin	0.10%				

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.012 Pass	0.155 Pass	0.0 Pass	0.157 Pass	
2	0.014 Pass	0.214 Pass	0.0 Pass	0.200 Pass	
3	0.015 Pass	0.196 Pass	0.0 Pass	0.180 Pass	
4	0.005 Pass	0.156 Pass	0.0 Pass	0.159 Pass	
5	0.016 Pass	0.154 Pass	0.0 Pass	0.149 Pass	
6	0.013 Pass	0.175 Pass	0.0 Pass	0.153 Pass	
7	0.011 Pass	0.206 Pass	0.0 Pass	0.156 Pass	
8	0.029 Pass	0.151 Pass	0.0 Pass	0.151 Pass	
9	0.009 Pass	0.188 Pass	0.0 Pass	0.158 Pass	
10	0.009 Pass	0.153 Pass	0.0 Pass	0.162 Pass	
11	0.026 Pass	0.181 Pass	0.0 Pass	0.159 Pass	
12	0.018 Pass	0.212 Pass	0.0 Pass	0.160 Pass	
Result	Pass	Pass	Pass	Pass	0.163 Pass

Plt	0.163	Limit	0.65

Test Impedance	R	0.4	Ω	X	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	X	0.15 * 0.25 ^	Ω
Maximum Impedance	R	--	Ω	X	--	Ω

Applies to three phase and split single phase **Micro-generators**.

^ Applies to single phase **Micro-generators** and **Micro-generators** 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*reference source resistance/measured source resistance at test point.

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 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 need to conform to the particular requirements set out in the testing notes for the technology under test. Dates and location of the test need to be noted below.

Power quality – DC injection				
Test power level	20%	50%	75%	100%
Recorded value in Amps	0.046	0.033	0.036	0.034
as % of rated AC current	0.35	0.25	0.27	0.26
Limit	0.5%	0.5%	0.5%	0.5%

Power Quality – Power factor			
	207 V	230 V	253 V
20% of **Registered Capacity**	0.997	0.998	0.998
50% of **Registered Capacity**	0.997	0.998	0.999
75% of **Registered Capacity**	0.998	0.998	0.998
100% of **Registered Capacity**	0.999	0.999	0.999
Limit	>0.95	>0.95	>0.95

Protection - Grid monitoring and reconnection time			
	Under frequency:		
Step for trip value [Hz to Hz]:	Setting threshold +1%Fn -> decrease by max 0.02Hz steps		
Step trip time [Hz to Hz]:	Trip value +0.1Hz -> Trip value -0.1Hz		
Setting value for trip value:	48.00 Hz		
Measurement accuracy of the tripping value [Hz]:	48.01 Hz	48.00 Hz	48.01 Hz
Setting value for trip time:	500 ms		
Measurement the trip time [ms]:	499 ms	500 ms	496 ms
	Over frequency:		
Step for trip value [Hz to Hz]:	Setting threshold +1%Fn -> increase by max. 0.02Hz steps		
Step trip time [Hz to Hz]:	Trip value +0.1Hz -> Trip value -0.1Hz		
Limit [Hz]:	50.50 Hz		
Measurement accuracy of the tripping value [Hz]:	50.50 Hz	50.51 Hz	50.50 Hz
Setting value for trip time:	500ms		
Measurement the trip time [ms]:	499 ms	498 ms	498 ms

		Under voltage:		
Step for trip value [V to V]:		Setting threshold +5%Vn -> decrease by max 1V steps		
Step for trip time [V to V]:		Trip value +2%Vn -> Trip value -2%Vn		
Setting value for trip value:		207V		
Measurement accuracy of the tripping value [V]:	L1:	207.2 V	207.0V	207.2 V
	L2:	--	--	--
	L3:	--	--	--
Setting value for trip time:		500 ms		
Measurement the trip time [ms]:	L1:	500 ms	502 ms	501 ms
	L2:	--	--	--
	L3:	--	--	--
		Over voltage:		
Step for trip value [V to V]:		Setting threshold +5%Vn -> increase by max 1V steps		
Step for trip time [V to V]:		Trip value -2%Vn -> Trip value +2%Vn		
Setting value for trip value:		253V		
Measurement accuracy of the tripping value [V]:	L1:	253.2 V	253.3 V	253.2 V
	L2:	--	--	--
	L3:	--	--	--
Setting value for trip time:		500		
Measurement the trip time [ms]:	L1:	498 ms	501 ms	500 ms
	L2:	--	--	--
	L3:	--	--	--

Note:
The above test result just for evaluation the interface protection system measure the voltage, frequency and trip time tolerance. If the product installation on the position should need confirmed the grid protection value with located DSO.
The interface protection system with voltage tolerance: ± 1%Vn.
The interface protection system with frequency tolerance: ± 0.05Hz.
The reset time shall be ≤50ms.

U [Vac] Set Value	Limit [Vac]	f [Hz] Set Value	Limits [Hz]	Input Power [%]	Connect/Reconnection Time [sec]	Active power increase gradient [%/min.]	Acceptability criteria
Start-up for UV:							
85%Un	U < 90%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	- - -	- - -	No connection
100%Un	90% <U< 110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	65 s	--	Delay for reconnection >60 s; Gradient: No requires.
80%Un	U < 90%	50,00 Hz	48,00 Hz <F< 50,50 Hz	Disconnect			
Re-connected for UV:							
85%Un	U < 90%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	- - -	- - -	No connection
95%Un	90% <U< 110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	64 s	9.33%	Delay for reconnection >60 s; Gradient:10%/min.
Start-up for OV:							
112%Un	U>110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	- - -	- - -	No connection
108%Un	90% <U< 110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	64 s	--	Delay for reconnection >60 s; Gradient: No requires.
115%Un	U>110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	Disconnect			
Re-connected for OV:							
112%Un	U>110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	- - -	- - -	No connection
108%Un	90% <U< 110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	64 s	9.66%	Delay for reconnection >60 s; Gradient:10%/min.
Start-up for UF:							
Un	90% <U< 110%	47,50 Hz	F< 48,00Hz	100 %	- - -	- - -	No connection
Un	90% <U< 110%	49,60 Hz	48,00 Hz <F< 50,50 Hz	100 %	65 s	9.68%	Delay for reconnection >60 s; Gradient: No requires.

Un	90% <U< 110%	47,40 Hz	F< UF	Disconnect			
Re-connected for UF:							
Un	90% <U< 110%	47,50 Hz	F< 48,00Hz	100 %	- - -	- - -	No connection
Un	90% <U< 110%	49,60 Hz	48,00 Hz <F< 50,50 Hz	100 %	66 s	9.68%	Delay for reconnection >60 s; Gradient:10%/min.
Start-up for OF:							
Un	90% <U< 110%	50,80 Hz	F>50.50Hz	100 %	- - -	- - -	No connection
Un	90% <U< 110%	50,00 Hz	48,00 Hz <F< 50,50 Hz	100 %	66 s	9.86%	Delay for reconnection >60 s; Gradient: No requires.
Un	90% <U< 110%	51,00 Hz	F>50,50 Hz	Disconnect			
Re-connected for OF:							
Un	90% <U< 110%	50,60 Hz	F > 50,50 Hz	100 %	- - -	- - -	No connection
Un	90% <U< 110%	50,10 Hz	48,00 Hz <F< 50,50 Hz	100 %	66 s	9.83%	Delay for reconnection >60 s; Gradient:10%/min.

Protection – Loss of Mains test						
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 2s	0.194 s	0.216 s	0.236s	0.208 s	0.216 s	0.224 s