



广州三晶电气股份有限公司
Guangzhou Sanjing Electric Co., Ltd.

Tel : 400-159-0088 Fax : 020-66608589

Web : www.saj-electric.cn / www.saj-electric.com

地址 : 广州高新技术产业开发区科学城谱汉山路9号三晶创新园

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	R5-3K-T2	R5-4K-T2	R5-5K-T2	R5-6K-T2
Max. AC Current [A]	3*5.0	3*6.7	3*8.4	3*10.0
Maximum Apparent Power [VA]	3300	4400	5500	6600
Product Type	R5-8K-T2	R5-9K-T2	R5-10K-T2	R5-12K-T2
Max. AC Current [A]	3*13.4	3*15.0	3*16.7	3*18.2
Maximum Apparent Power [VA]	8800	9900	11000	12000
Generating Unit technology	Three 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	2021-7-16 to 2021-7-18			
Compliant to	-Requirements to Type A Generation Unit. -Commision Regulation (EU) 2016/631 (NC RfG).			

Date:

2021.7.19

Signature:





Type Test Verification Report

Models R5-3K-T2, R5-4K-T2, R5-5K-T2, R5-6K-T2, R5-8K-T2, R5-9K-T2 R5-10K-T2 and R5-12K-T2 have the same structure, software logic and hardware structure, Except for the different model names, all tests are performed in R5-12K-T2.

Power Quality - Harmonics: These tests should be carried out as specified in EN 61000-3-12. 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.

Phase L1		Power Generating Module rating per phase (rpp)		4	kVA	
Harmonic	At 45-55% of Registered Capacity		100% of Registered Capacity		Limit in EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.062	0.358	0.215	1.236	8%	8%
3	0.088	0.509	0.102	0.589	21.6%	Not stated
4	0.020	0.118	0.030	0.174	4%	4%
5	0.075	0.432	0.091	0.525	10.7%	10.7%
6	0.027	0.152	0.029	0.168	2.67%	2.67%
7	0.169	0.974	0.171	0.981	7.2%	7.2%
8	0.041	0.237	0.017	0.097	2%	2%
9	0.078	0.449	0.103	0.593	3.8%	Not stated
10	0.013	0.076	0.051	0.291	1.6%	1.6%
11	0.103	0.590	0.182	1.048	3.1%	3.1%
12	0.018	0.103	0.005	0.026	1.33%	1.33%
13	0.077	0.441	0.136	0.779	2%	2%
THD ¹	--	1.940	--	1.468	23%	13%
PWHD ²	--	4.438	--	3.702	23%	22%

¹ THD = Total Harmonic Distortion

² PWHD = Partial Weighted Harmonic Distortion



Phase L2		Power Generating Module rating per phase (rpp)		4	kVA	
Harmonic	At 45-55% of Registered Capacity		100% of Registered Capacity		Limit in EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.062	0.358	0.210	1.205	8%	8%
3	0.081	0.509	0.104	0.600	21.6%	Not stated
4	0.020	0.118	0.040	0.232	4%	4%
5	0.092	0.432	0.077	0.444	10.7%	10.7%
6	0.015	0.152	0.023	0.135	2.67%	2.67%
7	0.163	0.974	0.178	1.023	7.2%	7.2%
8	0.037	0.237	0.021	0.119	2%	2%
9	0.114	0.449	0.086	0.493	3.8%	Not stated
10	0.011	0.076	0.056	0.324	1.6%	1.6%
11	0.097	0.590	0.185	1.061	3.1%	3.1%
12	0.009	0.103	0.010	0.058	1.33%	1.33%
13	0.074	0.441	0.135	0.777	2%	2%
THD ¹	--	1.977	--	1.450	23%	13%
PWHD ²	--	4.096	--	3.572	23%	22%

¹ THD = Total Harmonic Distortion

² PWHD = Partial Weighted Harmonic Distortion



Phase L3		Power Generating Module rating per phase (rpp)		4	kVA	
Harmonic	At 45-55% of Registered Capacity		100% of Registered Capacity		Limit in EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.054	0.310	0.202	1.162	8%	8%
3	0.077	0.445	0.129	0.742	21.6%	Not stated
4	0.040	0.229	0.018	0.104	4%	4%
5	0.073	0.418	0.076	0.438	10.7%	10.7%
6	0.018	0.105	0.045	0.260	2.67%	2.67%
7	0.152	0.871	0.199	1.147	7.2%	7.2%
8	0.045	0.257	0.013	0.074	2%	2%
9	0.109	0.626	0.095	0.546	3.8%	Not stated
10	0.017	0.099	0.037	0.212	1.6%	1.6%
11	0.115	0.661	0.183	1.049	3.1%	3.1%
12	0.011	0.062	0.017	0.098	1.33%	1.33%
13	0.075	0.432	0.135	0.775	2%	2%
THD ¹	--	1.918	--	1.481	23%	13%
PWHD ²	--	3.551	--	3.340	23%	22%

¹ THD = Total Harmonic Distortion

² PWHD = Partial Weighted Harmonic Distortion



Power Quality – Voltage fluctuations and Flicker:

Phase L1

Element	3		Element3	Judgement	Pass
Volt Range	300 V/50Hz		Total	Judgement	Pass
Un (U3)	230.452V		(Element1,2,3)		
Freq (U3)	50.004Hz				
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	0.045 Pass	0.167 Pass	0.0 Pass	0.147 Pass	
2	0.047 Pass	0.176 Pass	0.0 Pass	0.156 Pass	
3	0.043 Pass	0.152 Pass	0.0 Pass	0.145 Pass	
4	0.040 Pass	0.176 Pass	0.0 Pass	0.140 Pass	
5	0.035 Pass	0.165 Pass	0.0 Pass	0.154 Pass	
6	0.029 Pass	0.149 Pass	0.0 Pass	0.149 Pass	
7	0.028 Pass	0.171 Pass	0.0 Pass	0.150 Pass	
8	0.041 Pass	0.161 Pass	0.0 Pass	0.152 Pass	
9	0.026 Pass	0.174 Pass	0.0 Pass	0.160 Pass	
10	0.024 Pass	0.179 Pass	0.0 Pass	0.147 Pass	
11	0.062 Pass	0.201 Pass	0.0 Pass	0.138 Pass	
12	0.049 Pass	0.178 Pass	0.0 Pass	0.146 Pass	
Result	Pass	Pass	Pass	Pass	0.149 Pass

Plt	0.149	Limit	0.65
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Phase L2

Element	1		Element1	Judgement	Pass
Volt Range	300 V/50Hz		Total	Judgement	Pass
Un (U1)	230.349V		(Element1,2,3)		
Freq (U1)	50.004Hz				
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	0.039 Pass	0.162 Pass	0.0 Pass	0.136 Pass	
2	0.014 Pass	0.144 Pass	0.0 Pass	0.126 Pass	
3	0.003 Pass	0.144 Pass	0.0 Pass	0.133 Pass	
4	0.006 Pass	0.189 Pass	0.0 Pass	0.141 Pass	
5	0.025 Pass	0.219 Pass	0.0 Pass	0.136 Pass	
6	0.027 Pass	0.168 Pass	0.0 Pass	0.134 Pass	
7	0.009 Pass	0.144 Pass	0.0 Pass	0.131 Pass	
8	0.007 Pass	0.137 Pass	0.0 Pass	0.132 Pass	
9	0.009 Pass	0.151 Pass	0.0 Pass	0.135 Pass	
10	0.048 Pass	0.181 Pass	0.0 Pass	0.132 Pass	
11	0.002 Pass	0.153 Pass	0.0 Pass	0.130 Pass	
12	0.031 Pass	0.170 Pass	0.0 Pass	0.138 Pass	
Result	Pass	Pass	Pass	Pass	0.134 Pass

Plt	0.134	Limit	0.65
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Phase L3

Element	2		Element2	Judgement	Pass
Volt Range	300 V/50Hz		Total	Judgement	Pass
Un (U2)	229.517V		(Element1,2,3)		
Freq (U2)	50.004Hz				
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	0.018 Pass	0.158 Pass	0.0 Pass	0.138 Pass	
2	0.015 Pass	0.156 Pass	0.0 Pass	0.136 Pass	
3	0.010 Pass	0.171 Pass	0.0 Pass	0.145 Pass	
4	0.007 Pass	0.220 Pass	0.0 Pass	0.142 Pass	
5	0.026 Pass	0.180 Pass	0.0 Pass	0.145 Pass	
6	0.024 Pass	0.147 Pass	0.0 Pass	0.150 Pass	
7	0.030 Pass	0.153 Pass	0.0 Pass	0.136 Pass	
8	0.007 Pass	0.126 Pass	0.0 Pass	0.136 Pass	
9	0.013 Pass	0.189 Pass	0.0 Pass	0.148 Pass	
10	0.026 Pass	0.166 Pass	0.0 Pass	0.134 Pass	
11	0.008 Pass	0.148 Pass	0.0 Pass	0.136 Pass	
12	0.037 Pass	0.170 Pass	0.0 Pass	0.152 Pass	
Result	Pass	Pass	Pass	Pass	0.142 Pass

Plt	0.142	Limit	0.65
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Test Impedance	R	0.24	Ω	X	0.15	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	0.066	0.052	0.056	0.048
as % of rated AC current	0.38	0.30	0.33	0.28
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	0.998	0.997	0.998	
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]:	48.00 Hz	48.02 Hz	48.01 Hz	
Setting value for trip time:	500 ms			
Measurement the trip time [ms]:	489 ms	488 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	50.50 Hz	50.51 Hz	
Setting value for trip time:	500ms			
Measurement the trip time [ms]:	490 ms	486 ms	488 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:	207.0 V	207.2V	207.2 V
	L2:	207.3 V	207.2 V	207.1 V
	L3:	207.3 V	207.3 V	207.2 V
Setting value for trip time:		500 ms		
Measurement the trip time [ms]:	L1:	500 ms	498 ms	501 ms
	L2:	502 ms	498 ms	498 ms
	L3:	500 ms	500 ms	501 ms
		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:	253.0 V	252.8 V	253.2 V
	L2:	253.2 V	252.9 V	253.0 V
	L3:	253.1 V	253.0 V	252.8 V
Setting value for trip time:		500		
Measurement the trip time [ms]:	L1:	498 ms	498 ms	500 ms
	L2:	502 ms	499 ms	498 ms
	L3:	500 ms	502 ms	501 ms
<p>Note:</p> <p>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.</p> <p>The interface protection system with voltage tolerance: $\pm 1\%V_n$.</p> <p>The interface protection system with frequency tolerance: $\pm 0.05\text{Hz}$.</p> <p>The reset time shall be $\leq 50\text{ms}$.</p>				



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 %	66 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 %	66 s	9.30%	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 %	65 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	9.62%	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 %	64 s	9.62%	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 %	62 s	9.62%	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 %	64 s	9.82%	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 %	64 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	0.196 s	0.210 s	0.230s	0.212 s	0.234 s	0.256 s	