广州三晶电气股份有限公司
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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	R5-13K-T2	R5-15K-T2	R5-17K-T2	R5-20K-T2
Max. AC Current [A]	3*21.7	3*25.0	3*28.4	3*33.4
Maximum Apparent Power [VA]	14300	16500	18700	22000
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	2021-7-17 to 2021-7-19			
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 R5-13K-T2, R5-15K-T2, R5-17K-T2 and R5-20K-T2 have the same structure, software logic and hardware structure, Except for the different model names, all tests are performed in R5-20K-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)		6.67	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	0.068	0.234	0.189	0.652	8%	8%
3	0.097	0.333	0.139	0.480	21.6%	Not stated
4	0.019	0.067	0.030	0.103	4%	4%
5	0.086	0.298	0.069	0.237	10.7%	10.7%
6	0.014	0.047	0.057	0.196	2.67%	2.67%
7	0.180	0.619	0.190	0.656	7.2%	7.2%
8	0.031	0.108	0.016	0.057	2%	2%
9	0.083	0.286	0.088	0.305	3.8%	Not stated
10	0.020	0.071	0.052	0.179	1.6%	1.6%
11	0.103	0.355	0.197	0.680	3.1%	3.1%
12	0.016	0.054	0.019	0.066	1.33%	1.33%
13	0.081	0.280	0.141	0.487	2%	2%
THD[1]	--	2.03	--	1.498	23%	13%
PWHD[2]	--	2.51	--	2.156	23%	22%

[1] THD = Total Harmonic Distortion

[2] PWHD = Partial Weighted Harmonic Distortion

Phase L2		**Power Generating Module** rating per phase (rpp)		6.67	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	0.096	0.329	0.182	0.626	8%	8%
3	0.074	0.257	0.121	0.418	21.6%	Not stated
4	0.042	0.144	0.028	0.096	4%	4%
5	0.065	0.223	0.092	0.316	10.7%	10.7%
6	0.030	0.105	0.021	0.073	2.67%	2.67%
7	0.186	0.641	0.199	0.687	7.2%	7.2%
8	0.042	0.145	0.042	0.146	2%	2%
9	0.105	0.362	0.098	0.338	3.8%	Not stated
10	0.004	0.013	0.037	0.129	1.6%	1.6%
11	0.122	0.420	0.184	0.635	3.1%	3.1%
12	0.018	0.060	0.004	0.015	1.33%	1.33%
13	0.081	0.278	0.133	0.459	2%	2%
THD[1]	--	2.17	--	1.462	23%	13%
PWHD[2]	--	2.92	--	2.113	23%	22%

[1] THD = Total Harmonic Distortion

[2] PWHD = Partial Weighted Harmonic Distortion

Phase L3		**Power Generating Module** rating per phase (rpp)		6.67	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	0.060	0.207	0.185	0.637	8%	8%
3	0.094	0.326	0.097	0.335	21.6%	Not stated
4	0.033	0.115	0.036	0.125	4%	4%
5	0.081	0.278	0.078	0.270	10.7%	10.7%
6	0.012	0.041	0.031	0.108	2.67%	2.67%
7	0.196	0.674	0.200	0.691	7.2%	7.2%
8	0.054	0.185	0.030	0.103	2%	2%
9	0.085	0.293	0.109	0.376	3.8%	Not stated
10	0.016	0.054	0.047	0.164	1.6%	1.6%
11	0.108	0.373	0.188	0.650	3.1%	3.1%
12	0.003	0.012	0.010	0.035	1.33%	1.33%
13	0.059	0.202	0.142	0.491	2%	2%
THD[1]	--	2.07	--	1.471	23%	13%
PWHD[2]	--	2.62	--	2.150	23%	22%

[1] THD = Total Harmonic Distortion

[2] PWHD = Partial Weighted Harmonic Distortion

Power Quality – Voltage fluctuations and Flicker:

Phase L1

Element	1				
Volt Range	300 V/50Hz		Element1	Judgement	Pass
Un (U1)	230.372V		Total	Judgement	Pass
Freq (U1)	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	0.028 Pass	0.170 Pass	0.0 Pass	0.145 Pass	
2	0.045 Pass	0.155 Pass	0.0 Pass	0.141 Pass	
3	0.018 Pass	0.191 Pass	0.0 Pass	0.136 Pass	
4	0.033 Pass	0.188 Pass	0.0 Pass	0.137 Pass	
5	0.020 Pass	0.175 Pass	0.0 Pass	0.145 Pass	
6	0.010 Pass	0.168 Pass	0.0 Pass	0.141 Pass	
7	0.032 Pass	0.169 Pass	0.0 Pass	0.138 Pass	
8	0.027 Pass	0.150 Pass	0.0 Pass	0.137 Pass	
9	0.017 Pass	0.223 Pass	0.0 Pass	0.155 Pass	
10	0.046 Pass	0.169 Pass	0.0 Pass	0.143 Pass	
11	0.000 Pass	0.148 Pass	0.0 Pass	0.133 Pass	
12	0.026 Pass	0.156 Pass	0.0 Pass	0.138 Pass	
Result	Pass	Pass	Pass	Pass	0.141 Pass

Plt	0.141	Limit	0.65

Phase L2

Element	2				
Volt Range	300 V/50Hz		Element2	Judgement	Pass
Un (U2)	229.545V		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	0.022 Pass	0.168 Pass	0.0 Pass	0.149 Pass	
2	0.042 Pass	0.148 Pass	0.0 Pass	0.148 Pass	
3	0.018 Pass	0.153 Pass	0.0 Pass	0.147 Pass	
4	0.022 Pass	0.159 Pass	0.0 Pass	0.143 Pass	
5	0.006 Pass	0.152 Pass	0.0 Pass	0.149 Pass	
6	0.012 Pass	0.137 Pass	0.0 Pass	0.147 Pass	
7	0.018 Pass	0.168 Pass	0.0 Pass	0.145 Pass	
8	0.031 Pass	0.188 Pass	0.0 Pass	0.148 Pass	
9	0.010 Pass	0.185 Pass	0.0 Pass	0.158 Pass	
10	0.015 Pass	0.175 Pass	0.0 Pass	0.146 Pass	
11	0.022 Pass	0.145 Pass	0.0 Pass	0.141 Pass	
12	0.018 Pass	0.167 Pass	0.0 Pass	0.144 Pass	
Result	Pass	Pass	Pass	Pass	0.147 Pass

Plt	0.147	Limit	0.65

Phase L3

Element	3				
Volt Range	300 V/50Hz	Element3	Judgement	Pass	
Un (U3)	230.340V	Total	Judgement	Pass	
Freq (U3)	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	0.042 Pass	0.196 Pass	0.0 Pass	0.150 Pass	
2	0.045 Pass	0.205 Pass	0.0 Pass	0.165 Pass	
3	0.040 Pass	0.219 Pass	0.0 Pass	0.185 Pass	
4	0.035 Pass	0.117 Pass	0.0 Pass	0.159 Pass	
5	0.037 Pass	0.175 Pass	0.0 Pass	0.151 Pass	
6	0.033 Pass	0.180 Pass	0.0 Pass	0.160 Pass	
7	0.016 Pass	0.188 Pass	0.0 Pass	0.169 Pass	
8	0.025 Pass	0.144 Pass	0.0 Pass	0.160 Pass	
9	0.031 Pass	0.175 Pass	0.0 Pass	0.188 Pass	
10	0.047 Pass	0.152 Pass	0.0 Pass	0.176 Pass	
11	0.033 Pass	0.174 Pass	0.0 Pass	0.163 Pass	
12	0.057 Pass	0.213 Pass	0.0 Pass	0.164 Pass	
Result	Pass	Pass	Pass	Pass	0.167 Pass

Plt	0.167	Limit	0.65

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	0.156	0.138	0.128	0.132
as % of rated AC current	0.47	0.41	0.38	0.40
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]:	48.01 Hz	48.00 Hz	48.01 Hz
Setting value for trip time:	500 ms		
Measurement the trip time [ms]:	492 ms	490 ms	498 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]:	50.49 Hz	50.51 Hz	50.51 Hz
Setting value for trip time:	500ms		
Measurement the trip time [ms]:	492 ms	488 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	207.1 V	207.2 V
	L2:	207.3 V	207.2 V	207.3 V
	L3:	207.2 V	207.3 V	207.2 V
Setting value for trip time:		500 ms		
Measurement the trip time [ms]:	L1:	500 ms	496 ms	502 ms
	L2:	498 ms	500 ms	500 ms
	L3:	498 ms	502 ms	502 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	252.9 V	253.2 V
	L2:	253.1 V	253.2 V	253.0 V
	L3:	253.0 V	252.9 V	252.8 V
Setting value for trip time:		500		
Measurement the trip time [ms]:	L1:	500 ms	496 ms	502 ms
	L2:	492 ms	498 ms	500 ms
	L3:	496 ms	502 ms	498 ms

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 %	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	9.36%	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 %	63 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 %	66 s	9.68%	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 %	62 s	9.52%	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 %	64 s	9.60%	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 %	65 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	9.80%	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	0.188 s	0.216 s	0.236s	0.208 s	0.224 s	0.236 s