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TEST REPORT RD1699/ UNE Regulating the connection to the electrical grid of small-scale power generation facilities.	
Report Reference No.....: 200407085GZU-001 Date of issue.....: 15 May 2020 Total number of pages.: 27 pages	
Testing Laboratory Name Intertek Testing Services Shenzhen Ltd. Guangzhou Branch Address Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China Testing location Same as above Tested by (printed name and signature) Sunny Lin Approved by Engineer (printed name and signature) Jason Fu Technical Team Leader	
Applicant's name NingBo Deye Inverter Technology Co., Ltd. Address No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China	
Test specification: Standard..... RD1699:2011 UNE 206006 IN:2011 UNE 206007-1 IN:2013 Non-standard test method..... N/A	
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Test item description Hybrid inverter Trade Mark  Manufacturer Same as Applicant Model/Type reference SUN-3.6K-SG03LP1-EU; SUN-5K-SG03LP1-EU	

Rating.....:	Model	SUN-3.6K-SG03LP1-EU		SUN-5K-SG03LP1-EU	
	PV Input				
	Max. DC input Voltage:	500Vdc			
	PV Isc	16.5A*2			
	DC input range:	100-500Vdc			
	Battery Input				
	Battery Type	Lead acid or Lithium-ion			
	Battery Voltage Range	40Vdc-60Vdc			
	Max Charging Current	90A		120A	
	Max Discharge Current	90A		120A	
	Output				
	Nominal AC output voltage:	230Vac			
	Nominal frequency:	50Hz			
	Nominal output power:	3600W		5000W	
	Max output current:	3960W		5500W	
	Rated AC Current	15.7A		21.7A	
	Max AC Current	18A		25A	
	Power factor:	0.8 Leading to 0.8 Lagging			
	Ingress protection:	IP65			
	Protection Class:	Class I			
	Operation Ambient Temp	-25℃ to +60℃			
	Software Version	Ver0108			

Summary of testing:

Tests performed (name of test and test clause):

RD1699:2011	Test Description
12.4	Power factor
14	Monitoring of voltage
	Monitoring of frequency
	Reconnection condition over frequency
	Isolation measurement
	Monitoring of DC-injection
	Residual current monitoring
DIN V VDE V 0126-1-1:2006-02	Test Description
6.1(4.1)	Functional safety (Redundancy)
6.5(4.5)	Resonant circuit test
UNE 206006 IN: 2011	Test Description
4	islanding
UNE 206007-1:2013 IN	Test description
5.1	DC components
5.7	Transient Voltage test
5.8	Network quality
5.9	Reconnection out of sync

Remark:

For all clauses, the model SUN-5K-SG03LP1-EU is type tested and valid for other models.

For clause 5.8: Current harmonics, the model SUN-5K-SG03LP1-EU and SUN-3.6K-SG03LP1-EU are type tested.

Testing location:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China

Copy of marking plate

Deye

Model No: SUN-3.6K-SG03LP1-EU

Product type	Hybrid inverter
Enclosure	IP65
Ambient Temperature	-25-60℃ (>45℃ derating)

Charge Mode

Battery Voltage	48Vd.c.(40V-60V)
Battery Current	90Ad.c.Max
AC Input Voltage	230Va.c. (180V -265V)
AC Input Frequency	50Hz(47Hz-52Hz)
AC Input Rated Current	15.7Aa.c.
Max AC Input Current	18Aa.c.Max
Max AC Input Power	3960W
PV Input Voltage	370Vd.c.(100Vd.c-500Vd.c)
MPPT Input Range	125Vd.c.-425Vd.c.
PV Input Current	11Ad.c.*2
Max PV Input Power	4680W
Max PV ISC	16.5Ad.c.*2

Utility-Interactive

AC Output Voltage	230Va.c. (180V -265V)
AC Output Frequency	50Hz(47Hz-52Hz)
AC Output Rated Current	15.7Aa.c.
AC Output Current	18Aa.c.Max
Max AC Output Power	3960W
AC Output Rated Power	3600W
AC Output Power Factor	0.8 leading to 0.8 lagging
Max AC ISC	50Aa.c.
Battery discharge Voltage	40V-60Vd.c.
Battery discharge Current	90Ad.c.Max
Battery discharge Power	3960W

Stand Alone

AC Output Voltage	230Va.c. (180V -265V)
AC Output Frequency	50Hz(47Hz-52Hz)
AC Output Rated Current	15.7Aa.c.
AC Output Power	3600W
Max Continuous AC Passthrough	35Aa.c.
Peak Output Power	7200W 10Second
Discharge Battery Voltage Range	40V-60Vd.c.
Max Discharge Current	90Ad.c.Max

This Grid support interactive inverter complies with VDE 0126-1-1:2013,IEC/EN62109-1:2010,IEC/EN62109-2:2011 ,AS/NZS 4777.2:2015.

SN:[1912134105]

Add: No.26 South YongJiang Road Beilun NingBo China

Deye

Model No: SUN-5K-SG03LP1-EU

Product type	Hybrid inverter
Enclosure	IP65
Ambient Temperature	-25-60℃ (>45℃ derating)

Charge Mode

Battery Voltage	48Vd.c.(40V-60V)
Battery Current	120Ad.c.Max
AC Input Voltage	230Va.c. (180V -265V)
AC Input Frequency	50Hz(47Hz-52Hz)
AC Input Rated Current	21.7Aa.c.
Max AC Input Current	25Aa.c.Max
Max AC Input Power	5500W
PV Input Voltage	370Vd.c.(100Vd.c-500Vd.c)
MPPT Input Range	125Vd.c.-425Vd.c.
PV Input Current	11Ad.c.*2
Max PV Input Power	6500W
Max PV ISC	16.5Ad.c.*2

Utility-Interactive

AC Output Voltage	230Va.c. (180V -265V)
AC Output Frequency	50Hz(47Hz-52Hz)
AC Output Rated Current	21.7Aa.c.
AC Output Current	25Aa.c.Max
Max AC Output Power	5500W
AC Output Rated Power	5000W
AC Output Power Factor	0.8 leading to 0.8 lagging
Max AC ISC	75Aa.c.
Battery discharge Voltage	40V-60Vd.c.
Battery discharge Current	120Ad.c.Max
Battery discharge Power	5500W

Stand Alone

AC Output Voltage	230Va.c. (180V -265V)
AC Output Frequency	50Hz(47Hz-52Hz)
AC Output Rated Current	21.7Aa.c.
AC Output Power	5000W
Max Continuous AC Passthrough	35Aa.c.
Peak Output Power	10000W 10Second
Discharge Battery Voltage Range	40V-60Vd.c.
Max Discharge Current	120Ad.c.Max

This Grid support interactive inverter complies with VDE 0126-1-1:2013,IEC/EN62109-1:2010,IEC/EN62109-2:2011 ,AS/NZS 4777.2:2015.

SN:[1907044001]

Add: No.26 South YongJiang Road Beilun NingBo China

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation

Test item particulars			
Temperature range.....: -25°C to +60°C			
AC Overvoltage category	☐ OVC I	☐ OVC II	☒ OVC III ☐ OVC IV
DC Overvoltage category	☐ OVC I	☒ OVC II	☐ OVC III ☐ OVC IV
IP protection class			
IP65			
Possible test case verdicts:			
- test case does not apply to the test object: N/A (Not applicable)			
- test object does meet the requirement: P (Pass)			
- test object does not meet the requirement.....: F (Fail)			
Testing			
Date of receipt of test item: 07 April 2020			
Date (s) of performance of tests: 07 April 2020 – 14 May 2020			
General remarks:			
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report. When determining for test conclusion, measurement uncertainty of tests has been considered. This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid. Throughout this report a point is used as the decimal separator.			

General product information:

The PCE under test (EUT) is Hybrid Inverter. During inverter, which convert the variable DC power generated from the photovoltaic (PV) arrays and Batteries to the stable utility AC power which can be fed into the commercial electrical grid. When charging, the grid converts the alternating current into direct current into the battery through the Hybrid Inverter.

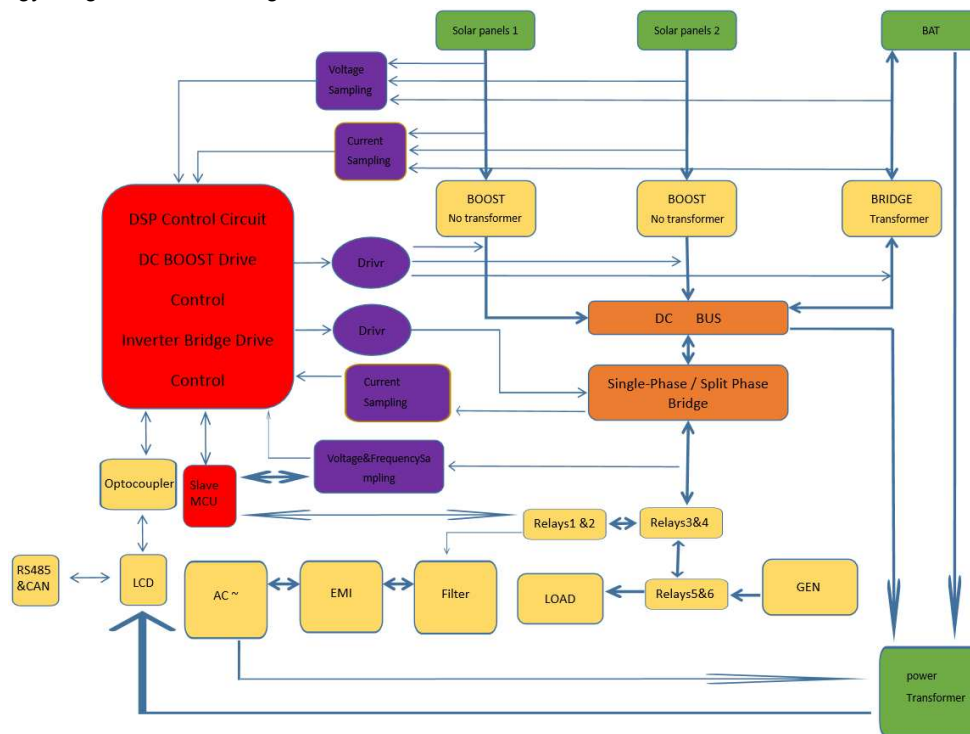
The PCE under test is single-phase Hybrid Inverter for solar power generation with the rating of 5kW, and 3.6kW.

The external circuit breakers or fuses for PV array, Batteries and Grid connection are required which the statements are provided in the installation manual.

The PCE does not provide galvanic separation between the PV array, Batteries and Grid connection circuit (Non-isolation or transformer-less type).

The Grid connection circuit can be switched off by two relays in series for the redundant protection. When single fault occurs to one relay, the other redundant one will still maintain the basic insulation between PV array, Batteries and Grid connection to the mains. All the relays have functional self-checking before the PCE starting.

The topology diagram as following:



Model differences:

The models of SUN-5K-SG03LP1-EU and SUN-3.6K-SG03LP1-EU hardware, the same software, only using software to limit power

Unless otherwise specified, all the tests were conducted on the basic model of SUN-5K-SG03LP1-EU.

The product was tested on:

The Software version: Ver0108

The Hardware version: V1.6

Factory information:

NingBo Deye Inverter Technology Co., Ltd.

No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China

RD1699:2011			
Article	Test description	Remark	Verified
12.4	Power factor	See appended table	P
14	Monitoring of voltage	See appended table	P
	Monitoring of frequency	See appended table	P
	Reconnection condition over frequency	See appended table	P
	Isolation measurement	Refer to test report: GZES190802173502 Issued by SGS- CSTC Standards Technical Services Co., Ltd. - E&E Lab Guangzhou	P
	Monitoring of DC-injection	See appended table	P
	Residual current monitoring	Refer to test report: GZES190802173502 Issued by SGS- CSTC Standards Technical Services Co., Ltd. - E&E Lab Guangzhou	P
Additional requirements of DIN V VDE V 0126-1-1:2006-02 are fulfilled:			
6.1 (4.1)	Functional safety (Redundancy)	See appended table	P
6.5(4.5)	Resonant circuit test	See appended table	P
UNE 206006 IN: 2011			
Article	Test description	Remark	Verified
4	Performance tests for islanding detection of multiple grid-connected photovoltaic inverters in parallel	See appended table	P
UNE 206007-1:2013 IN			
Article	Test description	Remark	Verified
5.1	DC components	See appended table	P
5.7	Transient Voltage test	See appended table	P
5.8	Network quality	See appended table	P
5.9	Reconnection out of sync	See appended table	P

A1.3 Type Verification Functional Testing of the Interface Protection Functional safety - fault condition tests according DIN V VDE V 0126-1-1							P
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1.	AC side	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	Shut down immediately. After fault removed, It can be work normally.No hazard No damaged. No hazard.
2.	DSP (U18)	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	Shut down immediately. After fault removed, It can be work normally.No hazard No damaged. No hazard
3.	DSP (U300)	failure of power	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
4.	C214	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	Battery mode does not work, PV mode is not affected. No damaged. No hazard.
5.	C165	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. Q30, Q32, Q31, Q35 and Fuse damaged. No hazard.
6.	R266	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	The PCE work normally. No damage. No hazard.
7.	RY6	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	The PCE work normally. No damage. No hazard.
8.	Q1 G-C	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PV 1 loss power. Q1 damaged. No hazard.
9.	Q1 G-E	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PV 1 loss power. Q1 damaged. No hazard.

10.	Q1 C-E	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PV 1 loss power. After fault removed, it can be work normally. No damaged. No hazard.
11.	R38	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	The PCE work normally. No damage. No hazard.
12.	R12	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	The PV1 voltage is not displayed correctly, the power metering is in error, and other functions are normal.
13.	C146	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
14.	C8	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
15.	C23	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
16.	C9	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
17.	RY2	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
18.	R277	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	The PCE work normally. No damage. No hazard.
19.	C64	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
20.	R227	S/C	PV: 500Vdc Battery side: 48Vdc	5min	--	--	PEC protected immediately. Q26 damaged. No hazard.

			AC output: 230Vac				
21.	R228	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
22.	R245	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. Q1 damaged. No hazard.
23.	C155	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
24.	C143	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
25.	C108	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
26.	C113	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
27.	C120	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
28.	C128	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
29.	C131	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. After fault removed, it can be work normally. No damaged. No hazard.
30.	C109	S/C before start	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	EUT cannot connect to the grid. Error message: "Relay-Check Failure". No output. No damage. No hazard.

31.	R202	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	PEC protected immediately. Disconnect from the grid. Q24 damaged. No hazard.
32.	R197	S/C before start	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	EUT cannot connect to the grid.No output. No damage. No hazard.
33.	C129	S/C before start	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	EUT cannot connect to the grid. No damage. No hazard.
34.	R203	S/C before start	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	EUT cannot connect to the grid. No damage. No hazard.
35.	K1 pin 7 and 9	S/C before start	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	EUT cannot connect to the grid. No damage. No hazard.
36.	K1 pin 3 and 6	S/C	PV: 500Vdc Battery side: 48Vdc AC output: 230Vac	5min	--	--	The PCE work normally. No damage. No hazard.

Article 12.4 Power factor					P
P/Pn	25%	50%	75%	100%	
Output power:	1259.47	2520.80	3770.22	5038.48	
Power factor	0.9825	0.9846	0.9913	0.9857	
Limit of PF	>0.98	>0.98	>0.98	>0.98	
Note: The power factor of the energy supplied to the supply company network shall be as close as possible to the unit value and in all case, greater than 0,98 if the facility is operating at powers of over 25 per cent of its nominal power.					

Article 14 Over Voltage								P	
Phase	Trip value measure d (V)	Trip time measured (ms)			Phase	Trip value measured (V)	Trip time measured (ms)		
		Stage 1					Stage 2		
		1	2	3			1	2	3
Trip voltage limit:		253 V			Trip voltage limit:		264.5 V		
L1	253.56	980	964	942	L1	264.72	180	188	196
L2	--	--	--	--	L2	--	--	--	--
L3	--	--	--	--	L3	--	--	--	--
Trip time limit:		≤1500 ms			≤200 ms				
Reconnection time measured:		194.8 s			194.4s				
Reconnection time limited:		≥ 180 s			≥ 180 s				

Article 14 Under Voltage					P
Phase	Trip value measured (V)	Trip time measured (ms)			--
		Stage 1			
		1	2	3	
Trip voltage limit:		195.5 V			
L1	195.17	642	680	700	
L2	--	--	--	--	
L3	--	--	--	--	
Trip time limit:		≤1500 ms			
Reconnection time measured		194.4 s			
Reconnection time limited		≥ 180 s			

Article 14 Under/Over frequency							P
Parameter	Trip value measured	Under frequency			Over frequency		
		Un-Trip time measured (ms)			Un-Trip time measured (ms)		
		1	2	3	1	2	3
Trip Frequency limit:		48 Hz			51		
Trip Frequency value:		48.02 Hz			51.03 Hz		
Trip time :		3100	3050	3020	208	188	187
Trip time limit:		at least 3 s			≤ 500 ms		
Reconnection time measured:		206.4			194.8		
Reconnection time limited:		≥ 180 s			≥ 180 s		
Note: The maximum and minimum frequency connection protection must be set to 51 Hz and 48,0 Hz. For an under frequency failure the inverter has to stay connect for at least 3 s. After the 3 s the inverter has to disconnect immediately from the grid. The accuracy for the frequency measurement must be in a range of +/- 0,05 Hz.							

Article 14 Protections Reconnection condition over frequency				P
Connecting conditions for frequencies:				
a)	50,00 Hz		inverter running	
	f_{ist}	Reset time:	Limit:	
	Switch to b) for $\geq$ Setting $T_{reconnection}$:			
b)	$\geq 50,50$ Hz	Not connected	inverter has to disconnect, no resetting allowed	
	Switch to c) for $\geq$ Setting $T_{reconnection}$:			
c)	50,05 Hz	Not connected	no resetting allowed	
	Switch to d) for $\geq$ Setting $T_{reconnection}$:			
d)	$\leq 50,00$ Hz	197 s	resetting allowed after $\geq$ Setting $T_{reconnection}$	

Article 14 Protections Monitoring of DC-Injection according DIN V VDE V 0126-1-1:2006-02, clause 6.4 (4.4)			P
DC Injection (A)	Limits	Trip Time (ms)	
-1 A	$I_{DC} > 1A$ than disconnection within 0,2 sec.	182	
+1 A	$I_{DC} > 1A$ than disconnection within 0,2 sec.	173	

5.1 DC injection/ UNE 206007-1:2013 IN				P
Test level power	25%	50%	100%	
Recorded value (A)	L1: 0.031	L1: 0.069	L1: 0.101	
	L2: --	L2: --	L2: --	
	L3: --	L3: --	L3: --	
As % of rated AC current	L1: 0.24%	L1: 0.32%	L1: 0.46%	
	L2: --	L2: --	L2: --	
	L3: --	L3: --	L3: --	
Limit	0.5% I_n	0.5% I_n	0.5% I_n	

5.7 Transient Voltage test / UNE 206007-1:2013 IN				P
Duration [s]	Transient Voltage Limits [U/Un]	Test output apparent power [VA]		
		60% output	80% output	100% output
		3000	4000	5000
		Measurements of Instantaneous Voltage (Line to Neutral) [U/Un]		
0.0002	280	64	48	-88
0.0006	218	32	16	-32
0.002	178	-8	-24	16
0.006	145	0	-24	8
0.02	129	-8	-16	8
0.06	120	-8	-8	8
0.2	120	-8	-8	-8
0.6	120	0	0	0

Note(s):

C = 100 μ F
R = 560 k Ω

5.8	TABLE: Current harmonics emission test				P
Current harmonics emission test for class A limit (According to UNE-EN 61000-3-2)					
Model: SUN-3.6K-SG03LP1-EU					
Active power P/Pn [%]	33	66	100	LIMIT (A)	
Nr./Order	Ih(A)	Ih(A)	Ih(A)		
2	0.0227	0.0429	0.0663	1.080	
3	0.0101	0.0134	0.0203	2.300	
4	0.0233	0.0485	0.0778	0.430	
5	0.0605	0.1656	0.2625	1.140	
6	0.0264	0.0312	0.0362	0.300	
7	0.0781	0.1400	0.2207	0.770	
8	0.0141	0.0119	0.0191	0.230	
9	0.0058	0.0045	0.0128	0.400	
10	0.0091	0.0220	0.0322	0.184	
11	0.0249	0.0657	0.0997	0.330	
12	0.0178	0.0135	0.0102	0.153	
13	0.0117	0.0521	0.0794	0.210	
14	0.0032	0.0065	0.0083	0.131	
15	0.0113	0.0082	0.0082	0.150	
16	0.0029	0.0021	0.0055	0.115	
17	0.0090	0.0344	0.0556	0.132	
18	0.0035	0.0090	0.0123	0.102	
19	0.0050	0.0208	0.0399	0.118	
20	0.0036	0.0025	0.0027	0.092	
21	0.0034	0.0039	0.0035	0.107	
22	0.0024	0.0011	0.0021	0.084	
23	0.0053	0.0151	0.0257	0.098	
24	0.0018	0.0034	0.0054	0.077	
25	0.0056	0.0115	0.0208	0.090	
26	0.0028	0.0023	0.0042	0.071	
27	0.0010	0.0010	0.0018	0.083	
28	0.0019	0.0009	0.0021	0.066	
29	0.0062	0.0069	0.0129	0.078	
30	0.0008	0.0015	0.0035	0.061	
31	0.0059	0.0061	0.0121	0.073	
32	0.0020	0.0009	0.0008	0.058	
33	0.0008	0.0004	0.0011	0.068	
34	0.0021	0.0003	0.0010	0.054	
35	0.0072	0.0062	0.0101	0.064	
36	0.0009	0.0004	0.0014	0.051	
37	0.0052	0.0033	0.0070	0.061	
38	0.0009	0.0007	0.0006	0.048	
39	0.0013	0.0006	0.0006	0.058	
40	0.0005	0.0009	0.0012	0.046	

5.8	TABLE: Current harmonics emission test				P
Current harmonics emission test for class A limit (According to CEI EN 61000-3-12)					
Model: SUN-5K-SG03LP1-EU					
Harmonic	33% Pn	66%Pn	100%Pn	Limit (%)	
2nd	0.4925	0.4439	0.4474	8.00	
3rd	0.1560	0.1102	0.1052	21.60	
4th	0.4002	0.4272	0.4971	4.00	
5th	1.5912	1.6494	1.6789	10.70	
6th	0.1850	0.1226	0.1707	2.67	
7th	1.0992	1.2502	1.2448	7.20	
8th	0.1206	0.1393	0.1367	2.00	
9th	0.0495	0.0345	0.0273	3.80	
10th	0.1805	0.2236	0.2195	1.60	
11th	0.4698	0.5834	0.6207	3.10	
12th	0.0572	0.0346	0.0259	1.33	
13th	0.3291	0.5086	0.4874	2.00	
PWHD	1.4227	1.8148	2.2828	23	
THD	2.1603	2.3516	2.4100	23	

4.8	TABLE: Flicker				P
Flicker measurement					
According to EN 61000-3-3/EN 61000-3-11					
Value	P _{st}	P _{lt}	d _c	d _{max}	
Limit	≤ 1	≤ 0.65	≤ 3.30%	4%	
Test value	0.688	0.569	0.185	0.00	

 Flicker Mode Flicker		Range Over U1 U2 U3 U4 U5 U6 U7 I1 I2 I3 I4 I5 I6 I7		Spd ☐ Scaling ☐ Line Filter ☐ Trq ☐ AVG ☒ Freq Filter ☐	Integral : Reset		CH: 1 2 3 4 5 6 7
Count 12/12 Complete Interval 00:00s/10:00s		Element 1 Volt Range 600 V/50Hz Un (Set) 230.000V Freq (U1) 50.015Hz		Element1 Total (Element1)		Judgement Pass Judgement Pass	
	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt		
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12		
No. 1	0.072 Pass	2.791 Pass	0.0 Pass	0.507 Pass			
2	0.090 Pass	2.896 Pass	0.0 Pass	0.581 Pass			
3	0.094 Pass	3.884 Pass	0.0 Pass	0.584 Pass			
4	0.094 Pass	3.852 Pass	0.0 Pass	0.504 Pass			
5	0.089 Pass	2.776 Pass	0.0 Pass	0.582 Pass			
6	0.062 Pass	3.941 Pass	0.0 Pass	0.601 Pass			
7	0.068 Pass	2.275 Pass	0.0 Pass	0.688 Pass			
8	0.185 Pass	2.246 Pass	0.0 Pass	0.586 Pass			
9	0.085 Pass	3.909 Pass	0.0 Pass	0.683 Pass			
10	0.108 Pass	2.781 Pass	0.0 Pass	0.583 Pass			
11	0.101 Pass	3.701 Pass	0.0 Pass	0.586 Pass			
12	0.092 Pass	3.991 Pass	0.0 Pass	0.608 Pass			
Result	Pass	Pass	Pass	Pass	0.569 Pass		

Element 1
U1 600 Vrms
I1 50 Arms
 Element 2
U2 600 Vrms
I2 50 Arms
 Element 3
U3 600 Vrms
I3 50 Arms
 Element 4
U4 600 Vrms
I4 50 Arms
 Element 5
U5 600 Vrms
I5 50 Arms
 Element 6
U6 600 Vrms
I6 50 Arms
 Element 7
U7 600 Vrms
I7 50 Arms
 Integral : Reset
 Time
 Timer
 0 : 00 : 30

5.9 Reconnection out of sync/ UNE 206007-1:2013 IN				P
Test	Output Power [W]	Phase displacement [°]	phase displacement [ms]	Result
1	5000	+90°	220	No damage Inverter disconnected
2	5000	-90°	220	No damage Inverter disconnected
3	5000	+180°	220	No damage Inverter disconnected
4	5000	180°	220	No damage Inverter disconnected

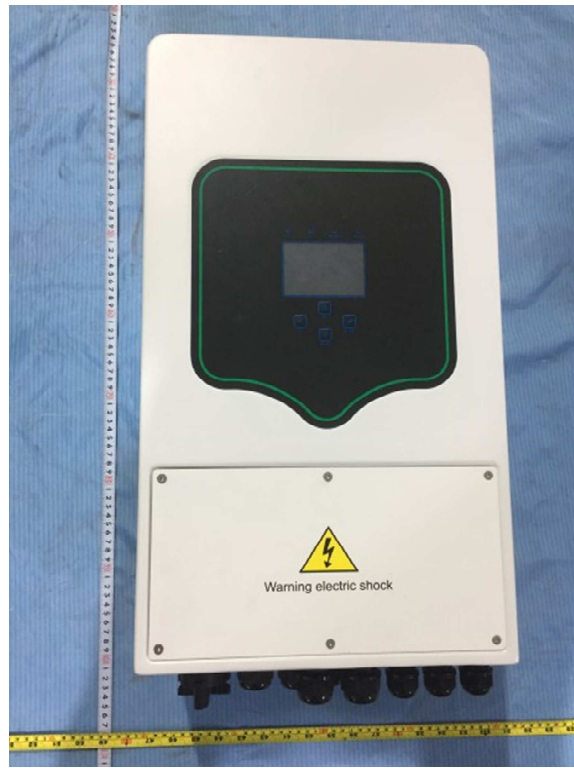
	L3: --	L3: --	L3: --	--	--	--
PR: -5% QC: -10%	L1: 5.265	L1: 4.921	L1: 5.592	1.49	900	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +10%	L1: 5.048	L1: 4.945	L1: 4.493	1.41	1188	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: -5% QC: +5%	L1: 5.287	L1: 4.938	L1: 4.744	0.93	708	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: -5% QC: 0%	L1: 5.284	L1: 4.933	L1: 5.111	0.95	938	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: -5% QC: -5%	L1: 5.279	L1: 4.928	L1: 5.360	0.98	606	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +5%	L1: 5.034	L1: 4.939	L1: 4.743	0.97	582	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: 0%	L1: 5.027	L1: 4.938	L1: 5.113	1.00	970	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -5%	L1: 5.024	L1: 4.934	L1: 5.360	1.02	766	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +5% QC: +5%	L1: 4.750	L1: 4.952	L1: 4.756	1.03	780	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +5% QC: 0%	L1: 4.744	L1: 4.944	L1: 5.121	1.05	994	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +5% QC: -5%	L1: 4.744	L1: 4.950	L1: 5.379	1.08	920	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -10%	L1: 5.031	L1: 4.930	L1: 5.598	1.05	780	2000
	L2: --	L2: --	L2: --	--	--	--

	L3: --	L3: --	L3: --	--	--	--
PR: +5% QC: +10%	L1: 4.749	L1: 4.952	L1: 4.501	1.00	1092	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +5% QC: -10%	L1: 4.739	L1: 4.941	L1: 5.613	1.10	552	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +10% QC: +10%	L1: 4.504	L1: 4.967	L1: 4.514	1.05	1396	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +10% QC: +5%	L1: 4.509	L1: 4.966	L1: 4.770	1.08	1130	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +10% QC: 0%	L1: 4.501	L1: 4.960	L1: 5.139	1.11	548	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 10% QC: -5%	L1: 4.495	L1: 4.956	L1: 5.390	1.14	796	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: +10% QC: -10%	L1: 4.498	L1: 4.921	L1: 5.628	1.16	662	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
Power 66%						
Conditions	P _w [W]	Q _L [Var]	Q _C [Var]	Q _f	Trip time [ms]	Limitation [ms]
PR: 0% QC: -5%	L1: 3.335	L1: 3.404	L1: 3.417	1.03	554	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -4%	L1: 3.333	L1: 3.403	L1: 3.394	1.02	564.0	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -3%	L1: 3.335	L1: 3.402	L1: 3.362	1.02	574	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -2%	L1: 3.336	L1: 3.403	L1: 3.330	1.01	516	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--

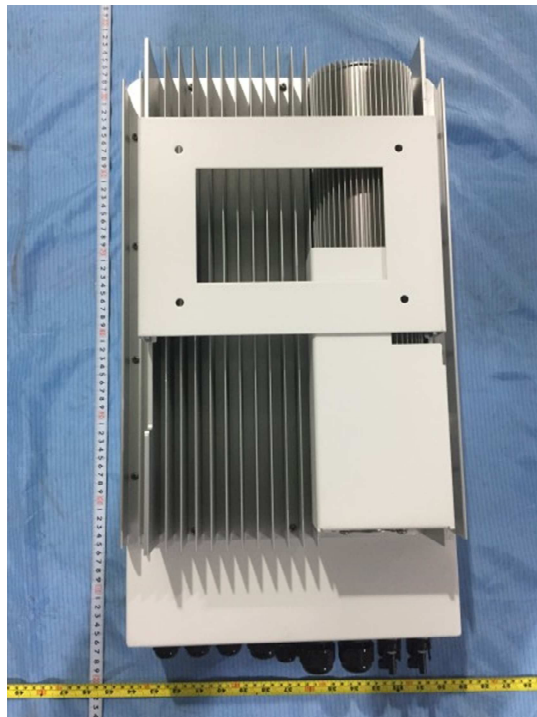
PR: 0% QC: -1%	L1: 3.336	L1: 3.402	L1: 3.294	1.01	508	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: 0%	L1: 3.331	L1: 3.403	L1: 3.261	1.00	990	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +1%	L1: 3.335	L1: 3.403	L1: 3.228	1.00	754	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +2%	L1: 3.332	L1: 3.402	L1: 3.195	0.99	730	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +3%	L1: 3.336	L1: 3.405	L1: 3.164	0.99	628	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +4%	L1: 3.334	L1: 3.405	L1: 3.132	0.98	924	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +5%	L1: 3.333	L1: 3.404	L1: 3.096	0.98	696	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
Power 33%						
Conditions	P _w [W]	Q _L [Var]	Q _C [Var]	Q _f	Trip time [ms]	Limitation [ms]
PR: 0% QC: -5%	L1: 1.663	L1: 1.668	L1: 1.723	1.02	590	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -4%	L1: 1.664	L1: 1.688	L1: 1.705	1.02	620	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -3%	L1: 1.664	L1: 1.688	L1: 1.689	1.01	754	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: -2%	L1: 1.664	L1: 1.688	L1: 1.606	1.01	538	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0%	L1: 1.665	L1: 1.689	L1: 1.657	1.00	526	2000

QC: -1%	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: 0%	L1: 1.666	L1: 1.689	L1: 1.642	1.00	862	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +1%	L1: 1.663	L1: 1.687	L1: 1.657	0.99	724	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +2%	L1: 1.664	L1: 1.688	L1: 1.606	0.99	522	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +3%	L1: 1.664	L1: 1.688	L1: 1.689	0.98	758	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +4%	L1: 1.655	L1: 1.689	L1: 1.574	0.98	750	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--
PR: 0% QC: +5%	L1: 1.664	L1: 1.689	L1: 1.557	0.97	684	2000
	L2: --	L2: --	L2: --	--	--	--
	L3: --	L3: --	L3: --	--	--	--

Appendix:



Top view of the unit



Back view of the unit



Side view of the unit



Terminal view of the unit



Internal view of the unit

--- End of test report---