





# SUMMARY TEST REPORT

**BUREAU  
VERITAS**

<b>Report reference number</b> .....	<b>PVFR2102WDG0105-3</b>
Date of issue .....	2021-04-19
Total number of pages .....	17
<b>Testing laboratory name</b> .....	<b>Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch</b>
Address .....	No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province, 523942, People's Republic of China
<b>Applicant's name</b> .....	<b>Shenzhen SOFARSOLAR Co., Ltd.</b>
Address .....	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.
<b>Test specification</b>	
Standard.....	According client's requirement
Test Report Form No. ....	SUMMARY TEST REPORT VER.1
TRF Originator .....	Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Master TRF .....	Dated 2021-03-26
<b>Test item description</b> .....	<b>Solar Grid-tied Inverter</b>
Trademark.....	
Model / Type .....	SOFAR 15KTLX-G3, SOFAR 17KTLX-G3, SOFAR 20KTLX-G3, SOFAR 22KTLX-G3, SOFAR 24KTLX-G3.
<small>This report is governed by, and incorporates by reference, CPS Conditions of Service as posted at the date of issuance of this report at <a href="http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions">http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions</a> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.</small>	

Ratings .....	SOFAR 15KTLX-G3	SOFAR 17KTLX-G3	SOFAR 20KTLX-G3	SOFAR 22KTLX-G3	SOFAR 24KTLX-G3
Input DC voltage [V]..... :	Max. 1100Vd.c.				
MPP DC voltage range [V]..... :	140-1000Vd.c.				
Input DC current [A] .....	26,0A / 26,0A				
Isc PV [A] .....	36,0A / 36,0A				
Output AC voltage [V] .....	380/400Va.c., 3W+N+PE; 50/60Hz				
Rated Output AC current [A]..... :	21,7	24,6	29,0	31,9	34,8
Max. Output AC current [A]..... :	23,9	27,1	31,9	35,1	38,3
Rated Output power [kW] .....	15,0	17,0	20,0	22,0	24,0
Max Output power [kVA] .....	16,5	18,7	22,0	24,2	26,4



<b>Testing Location</b> .....	<b>Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch</b>
Address .....	No. 96, Guantai Road (Houjie Section), Houjie Town, Dongguan City, Guangdong Province, 523942, People's Republic of China
Tested by (name and signature).....	Jack Shi 
Approved by (name and signature).....	Ken Chan 
<b>Manufacturer's name</b> .....	<b>Shenzhen SOFARSOLAR Co., Ltd.</b>
Manufacturer address .....	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.
<b>Factory's name</b> .....	<b>Dongguan SOFAR SOLAR Co.,Ltd.</b>
Factory address .....	1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City.

<b>Document History</b>			
<b>Date</b>	<b>Internal reference</b>	<b>Modification / Change / Status</b>	<b>Revision</b>
2021-04-15	Jack Shi	Initial report was written	0
Supplementary information:			

**Test items particulars**

Equipment mobility .....	: Permanent connection
Operating condition .....	: Continuous
Class of equipment .....	: Class I
Protection against ingress of water ..	: IP65 according to EN 60529
Mass of equipment [kg] .....	: Approx. 20,0 kg for SOFAR 15KTLX-G3; Approx. 22,0 kg for SOFAR 17KTLX-G3, SOFAR 20KTLX-G3; Approx. 23,0 kg for SOFAR 22KTLX-G3, SOFAR 24KTLX-G3.

**Test case verdicts**

Test case does not apply  
to the test object.....: N/A

Test item does meet  
the requirement.....: P(ass)

Test item does not meet  
the requirement.....: F(ail)

**Testing**

Date of receipt of test item .....: 2021-03-19  
Date(s) of performance of test .....: 2021-03-19 to 2021-03-27

**General remarks:**

The test result presented in this report relate only to the object(s) tested. This report shall not be reproduced in part or in full without the written approval of the issuing testing laboratory.

“(see Annex #)” refers to additional information appended to the report.

“(see appended table)” refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.



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Report No. PVFR2102WDG0105-3:

**This Test Report consists of the following documents:**

1. Test Report
2. Annex No. 1 – Pictures of the unit
3. Annex No. 2 – Test equipment list

Copy of marking plate

**SOFAR** Solar Grid-tied Inverter  
SOLAR

Model No:	SOFAR 15KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE, 380/400V
Max. Output Current	3x23.9A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	15000W
Max. Output Power	16500VA
Power Factor	1 (adjustable +/- 0.8)
Ingress Protection	IP65
Operating Temperature Range	-30°C~ +60°C
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.  
Address : 401, Building 4, AnTongDa Industrial Park,  
District 68, XingDong Community, XinAn Street,  
BaoAn District, Shenzhen, China  
VDE0126-1-1, VDE-AR-N4105, G99, IEC61727  
IEC62116, UTE C15-712-1, AS4777



**SOFAR** Solar Grid-tied Inverter  
SOLAR

Model No:	SOFAR 17KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE, 380/400V
Max. Output Current	3x27.1A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	17000W
Max. Output Power	18700VA
Power Factor	1 (adjustable +/- 0.8)
Ingress Protection	IP65
Operating Temperature Range	-30°C~ +60°C
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.  
Address : 401, Building 4, AnTongDa Industrial Park,  
District 68, XingDong Community, XinAn Street,  
BaoAn District, Shenzhen, China  
VDE0126-1-1, VDE-AR-N4105, G99, IEC61727  
IEC62116, UTE C15-712-1, AS4777



**SOFAR** Solar Grid-tied Inverter

Model No:	SOFAR 20KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x31.9A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	20000W
Max.Output Power	22000VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30°C~+60°C
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.  
Address : 401, Building 4, AnTongDa Industrial Park,  
District 68, XingDong Community,XinAn Street,  
BaoAn District, Shenzhen, China  
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727  
IEC62116,UTE C15-712-1,AS4777



**SOFAR** Solar Grid-tied Inverter

Model No:	SOFAR 22KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x35.1A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	22000W
Max.Output Power	24200VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30°C~+60°C
Protective Class	Class I

Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.  
Address : 401, Building 4, AnTongDa Industrial Park,  
District 68, XingDong Community,XinAn Street,  
BaoAn District, Shenzhen, China  
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727  
IEC62116,UTE C15-712-1,AS4777



**SOFAR** Solar Grid-tied Inverter

Model No:	SOFAR 24KTLX-G3
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	140~1000V
Max. Input Current	26A/26A
Max. PV Isc	36A/36A
Nominal Grid Voltage	3/N/PE,380/400V
Max.Output Current	3x38.3A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	24000W
Max.Output Power	26400VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-30°C~+60°C
Protective Class	Class I

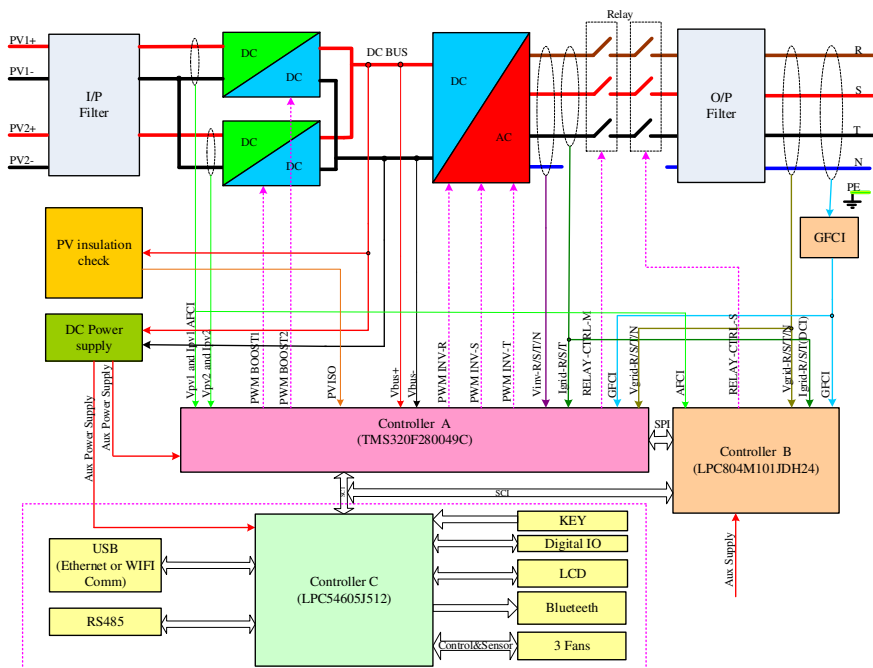
Made in China

Manufacturer : Shenzhen SOFARSOLAR Co.,Ltd.  
Address : 401, Building 4, AnTongDa Industrial Park,  
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BaoAn District, Shenzhen, China  
VDE0126-1-1,VDE-AR-N4105,G99,IEC61727  
IEC62116,UTE C15-712-1,AS4777



**General product information:**

The Solar Grid-tied Inverter converts DC voltage into AC voltage. The DC input of Solar Grid-tied Inverter can be supplied from PV array. The Solar Grid-tied Inverter is a three-phase type . The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit will also operate in case of one error.



**Figure 1-Block diagram**

The internal control is redundant built. It consists of Main DSP (U30) and slave DSP(U23). The Main DSP (U30) can control the relays, measures voltage, and frequency, AC current with injected DC, insulation resistance and residual current, In addition it tests the array insulation resistance and the RCMU circuit before each start up. The slave DSP (U23) is using for detect residual current, also can open the relays independently and communicate with Main DSP (U30). The unit provides two relays in series on Line and Neutral conductors. When single-fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the PV array and the mains. All the relays are tested before start up. Both controllers(Main DSP (U30), Slave DSP (U23) can open the relays.



**Differences of the models:**

The models SOFAR 15KTLX-G3, SOFAR 17KTLX-G3, SOFAR 20KTLX-G3, SOFAR 22KTLX-G3 and SOFAR 24KTLX-G3 are use the identical hardware platform, control unit, control system and software except the output power derated by software and in following table descripts for different.

	SOFAR 15KTLX-G3	SOFAR 17KTLX-G3	SOFAR 20KTLX-G3	SOFAR 22KTLX-G3	SOFAR 24KTLX-G3
Thin-film capacitor of BUS	4pcs (110uF, 550V)	6pcs (110uF, 550V)			
INV IGBT (Q60, Q67, Q71 Q72, Q75, Q76)	6pcs 40A, 1200V	6pcs 75A, 1200V			
External Fan	1		2		

**The product was tested on:**

Hardware version: V101

Software version: V010000

Per client requested, all tests were performed on EUT of SOFAR 24KTLX-G3.

## TECHNOLGY

Nominal output power of the inverter	24,00 kW
Nominal current - $I_n$	34,80 A
Maximum apparent power of the inverter	26,40 kVA
Power electronics type	<input type="checkbox"/> Assisted switching (Thyristors) <input checked="" type="checkbox"/> Forced switching (IGBT-MLI)
Rated output voltage	400 V
Connection type	<input type="checkbox"/> Single phase <input checked="" type="checkbox"/> Three phase

## IMPEDANCE AT 175 Hz

Impedance of the converter at 175 Hz - R and X in ohm, give the values on the LV side (not taken into account of the transformer)	<input checked="" type="checkbox"/> Serial equivalent schema	$R_{175Hz}=5,10 \quad \Omega$
	<input type="checkbox"/> Parallel equivalent schema	$X_{175H}=-1,00 \quad \Omega$

## BEHAVIOR IN CASE OF SHORT INVERTER OUTPUT CIRCUIT

Values measured at the output of the aero generator, give the values on the LV side (not taken into account of the transformer)	$I_p=85,3 \quad A$
	$I_{k''}=10,2 \quad A$

**HARMONIC:**

Order	Harmonic current	Order	Harmonic current
	%In		%In
2	0,028	3	0,281
4	0,017	5	0,376
6	0,013	7	0,348
8	0,009	9	0,084
10	0,010	11	0,309
12	0,014	13	0,301
14	0,011	15	0,087
16	0,007	17	0,149
18	0,008	19	0,143
20	0,006	21	0,054
22	0,004	23	0,102
24	0,004	25	0,091
26	0,003	27	0,038
28	0,004	29	0,078
30	0,004	31	0,078
32	0,003	33	0,044
34	0,003	35	0,069
36	0,003	37	0,065
38	0,003	39	0,030
40	0,003	41	0,062
42	0,002	43	0,054
44	0,003	45	0,019
46	0,006	47	0,056
48	0,006	49	0,062
50	0,003	--	--

**Note:**

The tests should be based on the limits of the EN 61000-3-12 for more than 16A.



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# Annex No. 1

## Pictures of the unit

### Enclosure front view



### Enclosure side view



**Enclosure bottom view  
SOFAR 15KTLX-G3, SOFAR 17KTLX-G3**



**Enclosure bottom view  
SOFAR 20KTLX-G3, SOFAR 22KTLX-G3, SOFAR 24KTLX-G3**



### Enclosure terminal view





Report No. PVFR2102WDG0105-3:

# Annex No. 2

## Test Equipment list



**Dates of performance test: 2021-03-19 to 2021-03-27**

Equipment	Internal No.	Manufacturer	Type	Serial No.	Next Calibration date
Power Analyzer	A4080002DG	YOKOGAWA	WT3000	91M210852	Jun, 16, 2021
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyzer
	A7040020DG	Chroma	61512	61512000438	
DC Simulation Power Supply	A7040016DG	Chroma	62150H-1000S	62150EF00490	
	A7040017DG	Chroma	620028	620028EF00120	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Eight Channel	A4089017DG	YOKOGAWA	DL850	91N726247	Sep. 23, 2021
Oscilloscope	//	KEYSIGHT	DSOX3014T	MY59243036	Jan. 04, 2022
Oscilloscope probel	A4089008DG	Tektronix	TPP1000	C008230	Aug. 10, 2021
	A4089010DG	Tektronix	TPP1000	C008228	Aug. 10, 2021
	A4089011DG	Tektronix	TPP1000	C008229	Aug. 10, 2021
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Sep. 02, 2021
	A1060008DG	YOKOGAWA	CT200	1130700017	Sep. 02, 2021
	A1060012DG	YOKOGAWA	CT200	1130700018	Sep. 02, 2021