TEST REPORT
DIN V VDE V 0126-1-1:2013.08
Automatic disconnecting device

Report Reference No.....:	180807101GZU-002
Date of issue.....:	04 Jan., 2019
Total number of pages.....:	28 pages
Testing Laboratory.....:	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/ address .....:	Same as above
Tested by (name + signature).....:	Jason Fu Senior Project Engineer
Approved by (+ signature).....:	Tommy Zhong Assistant Technical Manager
Applicant's name.....:	Shenzhen SOFAR SOLAR Co., Ltd.
Address.....:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China
Test specification:	
Standard .....:	DIN V VDE V 0126-1-1:2013.08 with VFR 2014
Test procedure.....:	Type approval for France
Non-standard test method……..:	N/A
Test Report Form No.....:	VDE0126-1-1b
Test Report Form(s) Originator .....:	Intertek
Master TRF.....:	Dated 2013-09

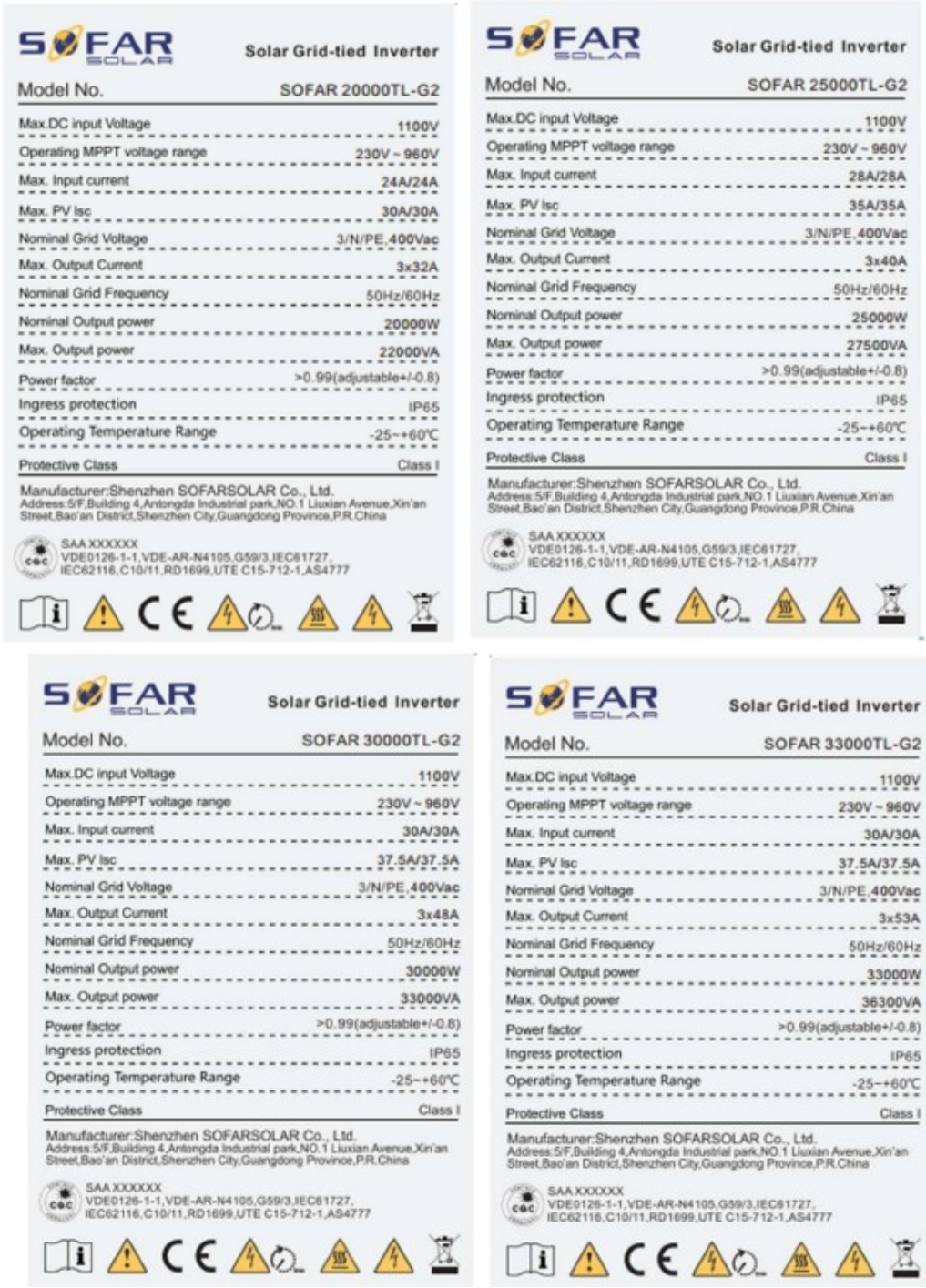
Test item description ..... :	Solar Grid-tied Inverter
Trade Mark .....:	SOFAR SOLAR
Manufacturer.....:	Same as Applicant
Model/Type reference.....:	SOFAR 20000TL-G2, SOFAR 25000TL-G2, SOFAR 30000TL-G2, SOFAR 33000TL-G2

Rating……:					
	Model	SOFAR 20000TL-G2	SOFAR 25000TL-G2	SOFAR 30000TL-G2	SOFAR 33000TL-G2
	Max. DC input Voltage	1100Vdc			
	Operating MPPT voltage range	230Vdc – 960Vdc			
	Max. Input current	24A/24A	28A/28A	30A/30A	30A/30A
	PV Isc	30A*2	35A*2	37.5A*2	37.5A*2
	Nominal AC output voltage	3/N/PE 230Vac/400Vac			
	Nominal AC output Frequency	50Hz			
	Nominal AC output Power	20000W	25000W	30000W	33000W
	Max.Output Power	22000VA	27500VA	33000VA	36300VA
	Power factor	0.8 Leading – 0.8 Lagging			
	Safety level	Class I			
	Ingress Protection	IP 65			
	Operation Ambient Temperature	-25℃ - 60℃			
	Software version	V1.40			

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All applicable test items.	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

Copy of marking plate(representative):



SOFAR SOLAR Solar Grid-tied Inverter

Model No.	SOFAR 20000TL-G2
Max.DC input Voltage	1100V
Operating MPPT voltage range	230V ~ 960V
Max. Input current	24A/24A
Max. PV Isc	30A/30A
Nominal Grid Voltage	3/N/PE,400Vac
Max. Output Current	3x32A
Nominal Grid Frequency	50Hz/60Hz
Nominal Output power	20000W
Max. Output power	22000VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25~+60℃
Protective Class	Class I

Manufacturer:Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial park,NO.1 Liuxian Avenue,Xin'an Street,Bao'an District,Shenzhen City,Guangdong Province,P.R.China

SAA XXXXXX
VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,
IEC62116,C10/11,RD1699,UTE C15-712-1,AS4777

SOFAR SOLAR Solar Grid-tied Inverter

Model No.	SOFAR 25000TL-G2
Max.DC input Voltage	1100V
Operating MPPT voltage range	230V ~ 960V
Max. Input current	28A/28A
Max. PV Isc	35A/35A
Nominal Grid Voltage	3/N/PE,400Vac
Max. Output Current	3x40A
Nominal Grid Frequency	50Hz/60Hz
Nominal Output power	25000W
Max. Output power	27500VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25~+60℃
Protective Class	Class I

Manufacturer:Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial park,NO.1 Liuxian Avenue,Xin'an Street,Bao'an District,Shenzhen City,Guangdong Province,P.R.China

SAA XXXXXX
VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,
IEC62116,C10/11,RD1699,UTE C15-712-1,AS4777

SOFAR SOLAR Solar Grid-tied Inverter

Model No.	SOFAR 30000TL-G2
Max.DC input Voltage	1100V
Operating MPPT voltage range	230V ~ 960V
Max. Input current	30A/30A
Max. PV Isc	37.5A/37.5A
Nominal Grid Voltage	3/N/PE,400Vac
Max. Output Current	3x48A
Nominal Grid Frequency	50Hz/60Hz
Nominal Output power	30000W
Max. Output power	33000VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25~+60℃
Protective Class	Class I

Manufacturer:Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial park,NO.1 Liuxian Avenue,Xin'an Street,Bao'an District,Shenzhen City,Guangdong Province,P.R.China

SAA XXXXXX
VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,
IEC62116,C10/11,RD1699,UTE C15-712-1,AS4777

SOFAR SOLAR Solar Grid-tied Inverter

Model No.	SOFAR 33000TL-G2
Max.DC input Voltage	1100V
Operating MPPT voltage range	230V ~ 960V
Max. Input current	30A/30A
Max. PV Isc	37.5A/37.5A
Nominal Grid Voltage	3/N/PE,400Vac
Max. Output Current	3x53A
Nominal Grid Frequency	50Hz/60Hz
Nominal Output power	33000W
Max. Output power	36300VA
Power factor	>0.99(adjustable+/-0.8)
Ingress protection	IP65
Operating Temperature Range	-25~+60℃
Protective Class	Class I

Manufacturer:Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial park,NO.1 Liuxian Avenue,Xin'an Street,Bao'an District,Shenzhen City,Guangdong Province,P.R.China

SAA XXXXXX
VDE0126-1-1,VDE-AR-N4105,G59/3,IEC61727,
IEC62116,C10/11,RD1699,UTE C15-712-1,AS4777

Note: 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.

Test item particulars.....:	
Temperature range .....:	-25°C ~ 60 °C
Overvoltage category.....:	☐ OVC I ☒ OVC II (for PV input) ☒ OVC III (for main) ☐ OVC IV
IP protection class .....:	IP65
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- 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 Aug 2018
Date (s) of performance of tests.....:	07 Aug 2018 to 31 Dec 2018

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.

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

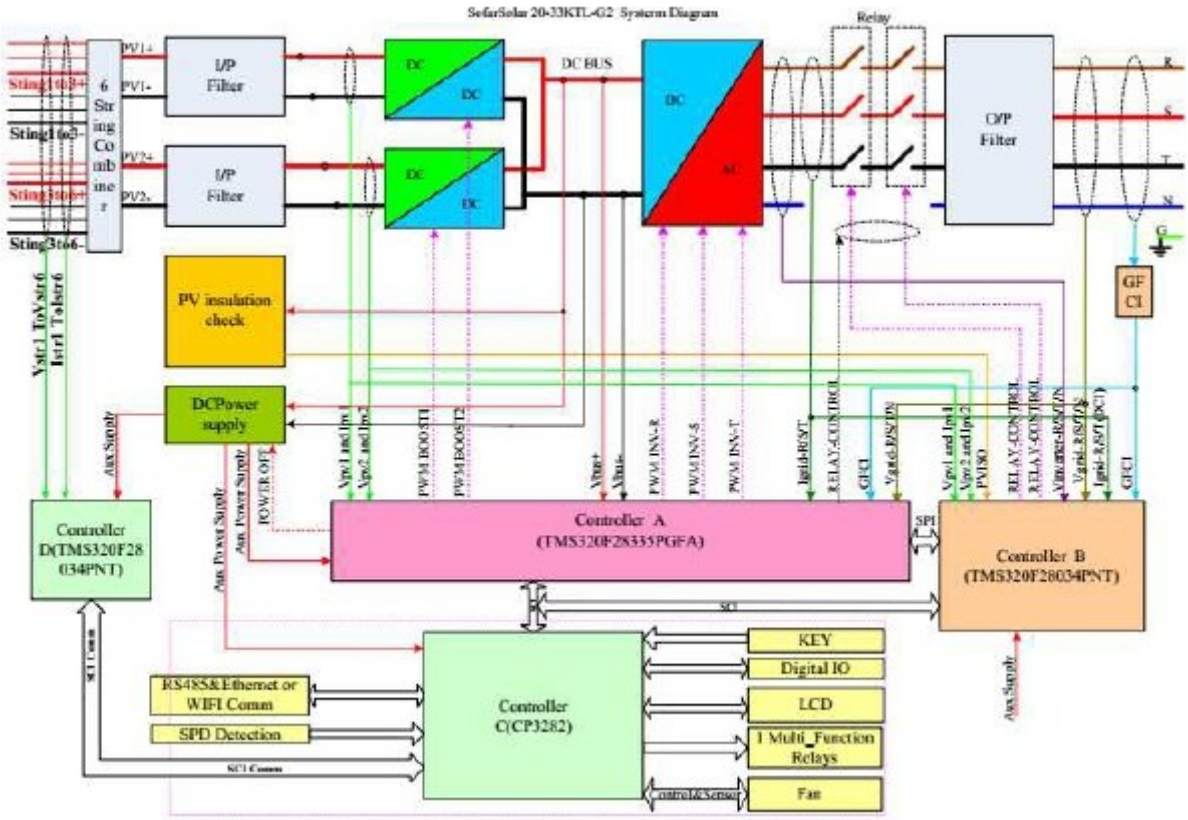
Clause numbers in parentheses derive from VDE-AR-N 4105:2011-08.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.

General product information:

The Solar converter 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 two relays. This assures that the opening of the output circuit will also operate in case of one error.



Block diagram

The internal control is redundant built. It consists of Main DSP(UC20) and slave DSP(UC73).
The Main DSP(UC20) 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(UC73) is using for detect residual current, also can open the relays independently and communicate with Main DSP(UC20).
The unit provides two relays in series on Line 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(UC20), Slave DSP(UC73) can open the relays.

The product was tested on:
Hardware version: V1.00
Software version: V1.40

Model difference:
The models SOFAR 20000TL-G2, SOFAR 25000TL-G2, SOFAR 30000TL-G2 and SOFAR 33000TL-G2 are almost identical in hardware except the shown in the following table and the output power derated by software.

The difference in hardware			
Item	SOFAR 20000TL-G2	SOFAR 25000TL-G2	SOFAR 30000TL-G2 / SOFAR 33000TL-G2
Number of PV terminal	2+2	3+3	
Number of BUS capacitance	8 capacitors: 550V/110μF 2 capacitors: 1100V/40μF		10 capacitors: 550V/110μF 4 capacitors: 1100V/40μF
INV inductance	785μH	735μH	
Combiner board	Not the board	Have the board	
External fan	Not the board	2	3
Relay of output board	6pcs T9VV1K15-12S		3pcs AZSR250-2AE-12D

Other than special notice, the model SOFAR 33000TL-G2 used as representative model for testing.

Factory information:

Dongguan SOFAR SOLAR Co., Ltd.

1F-6F, Building E, No.1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City.

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
4	**REQUIREMENTS**		P
4.0	**General**		P
	These requirements apply to integrated or separate (independent) disconnecting devices unless otherwise noted. The disconnection device has to cut off the power generating system on the ac side from the grid by two switches in series when: — the voltage and/or the frequency of the grid is deviating, — direct current (DC) is fed into the Grid. — unintentional islanding operation occurs, — intentional islanding operation using grid backup systems (emergency supplies).		P
4.1	**Functional safety**		P
	The safety must be assured under all operating conditions complying with the defined functions 4.3 to 4.6 and – if applicable – 4.8 of the disconnection device. The disconnection device can be an independent unit or an integrated part of the power generating unit and must switch off in case of a fault and indicate the fault status	Considered, see Annex. The single fault safe system was reviewed. The theoretical investigation was verified by error simulation.	P
4.1.1	**Single fault tolerance**		P
	The disconnection device must comply with the single fault tolerance requirements of VDE-AR-N 4105:2011-08, A.6	Considered, functional explanation and table 6.1 below.	P
4.1.2	**Interface Switch**		P
	The interface switch must, in case it is integrated into a PV-inverter, comply with the requirements of DIN EN 62109-2(VDE 0126-14-2):2012-04, 4.4.4.15.2 and in all other cases with the requirements according to VDE-AR-N 4105:2011-08, 6.4.	Disconnection takes place redundant through two relays and the IGBT-full bridge in series. The relays and the IGBT-full bridge are able to switch the full current.	P
(6.4.1)	**General**		P
	For the connection of the power generation system to the network operator's low-voltage network or to the remaining customer system, it is necessary to use an interface switch. It consists of two electric switching devices connected in series and shall thus be constructed redundantly. The interface switch is controlled by the NS protection and activates automatically if at least one protective function responds. The breaking devices of the interface switch shall be designed to be short-circuit proof and shall be		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	releasable without delay and with due regard to the protective devices required by clause 6.5. The breaking capacity of the two breaking devices of the interface switch shall be dimensioned at least in accordance with the responding range of the upstream safety fuse or the maximum short-circuit current contribution of the power generation system. Switches with at least breaking capacity shall be use for both breaking devices of the interface switch. In addition to that, all-pole disconnection shall be ensured.		
(6.4.2)	**Central interface switch**		N/A
	The two break devices of the central interface switch shall be executed as galvanic break devices. The two break devices of the interface switch shall be installed directly at the central meter panel in the circuit distributor of the power generation system.		N/A
(6.4.3)	**Integrated interface switch**		P
	Construction of the interface switch shall be carried out taking into consideration the single-fault tolerance. An interface switch ensures a single-fault tolerant all-phase galvanic breaking. For power generation systems with inverters, the interface switch shall be provided on the inverter's network side. A short circuit in the inverter shall not impair the switching function of the interface switch.		P
4.2	**Connection conditions**		P
	The connection, the reconnection after a grid-fault and the reconnection after short interruption shall be carried out according to VDE-AR-N 4105:2011-08, 8.3.1		P
(8.3.1)	**General**		P
	A power generation system shall be connected to the network operator's network only if a suitable device determines that both the mains voltage and the mains frequency are within the tolerance range of 85 % Un to 110 % Un or 47.5 Hz to 50.05 Hz, respectively, for a period of at least 60 seconds. If decoupling protection devices are tripped because of a short interruption, then the power generation system is permitted to already reconnect as soon as the mains voltage and mains frequency have uninterruptedly remained within the tolerance ranges given above for a period of 5 seconds. Short time interruptions are characterised by the NS protection settings of the mains frequency and/ or network voltage being exceeded or undershot for a maximum period of 3 seconds. The power generation system being reconnected to the	Tested with a variable AC-Power supply at the output. Inverter disconnects within the limits, see table 6.2 below.	P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	network operator's network at the tripping of the decoupling protection device, the active power of controllable power generation systems supplied to the network operator's network shall not exceed the gradient of 10 % of the active power per minute.		
4.3	**Monitoring the voltage**		P
4.3.1	**voltage drop U<**		P
	The disconnection because of a voltage drop shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.3.2	**rise-in-voltage U>>**		P
	The disconnection because of a rise-in-voltage shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.3.3	**slow rise-in-voltage U>**		P
	The disconnection because of a slow rise-in-voltage (10-minute-average) shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.4	**Monitoring the frequency**		P
	The disconnection because of a frequency decrease or a frequency increase shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
(6.5.1)	**General**		P
	The purpose of the NS protection is to disconnect the power generation system from the net in the event of inadmissible voltage and frequency values. This is intended to prevent an unintentional feed-in of the power generation system into a power-supply unit separated from the remaining distribution network as well as the feed-in of faults within this network. The system operator shall himself take precautions to prevent damages to his systems and installations as might be caused by switching actions, voltage fluctuations and automatic reclosings in the network connected upstream or other process in the network of the network operator. The following functions of the decoupling protection shall be implemented: - Voltage drop protection *U* <; - Rise-in-voltage protection *U* >; - Rise-in-voltage protection *U* >>; - Frequency decrease protection *f* <; - Frequency increase protection *f* >; - Islanding detection.		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	The setting values of the protective functions and the last five dated failure reports shall be readable at the NS protection. Interruptions of supply with durations of 3 s or longer shall not lead to loss of any of the failure reports. Read-out shall be possible at the central NS protection irrespective of the operational state of the power generation system and without any additional aids. For integrated NS protection read-out may be carried out using a data interface.		
(6.5.2)	**Protective functions**		P
	The protective functions of the NS protection shall be designed so that the disconnection time (the sum of the proper times of NS protection and interface switch plus a delay for the protection relay, which may or may not be adjustable) does not exceed 200 ms.		P
4.5	**Monitoring the dc current**		P
	A feed in of d.c current into the low-voltage grid due to defective equipment must lead to a switch off within 0.2 seconds. For this purpose the fault itself or a measurement of the dc component of the current exceeding 1 A can be used as disconnection criteria.	See appended table below.	P
4.6	**Detection of islanding operation**		P
	The disconnection because of a detection of unintended islanding operation shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.3	See appended table below.	P
(6.5.3)	**Islanding detection**		P
	The islanding detection is implemented in the central NS protection or in the integrated NS protection of the power generation unit. If an islanding detection system acting on the integrated interface switch is integrated in all power generation units of a power generation system, then it is permitted to omit the islanding detection in the central NS protection regardless of the system power. Detection of an isolated network and disconnection of the power generation system by means of the interface switch shall be completed within 5 seconds.	See appended table below.	P
4.7	**Markings**		P
	A generating system equipped with an automatic disconnecting device shall be marked with the information “VDE 0126-1-1” which is visible from the outside. This can be done by — the marking plate or — showing it on a display of the disconnection device or — a separate marking		P

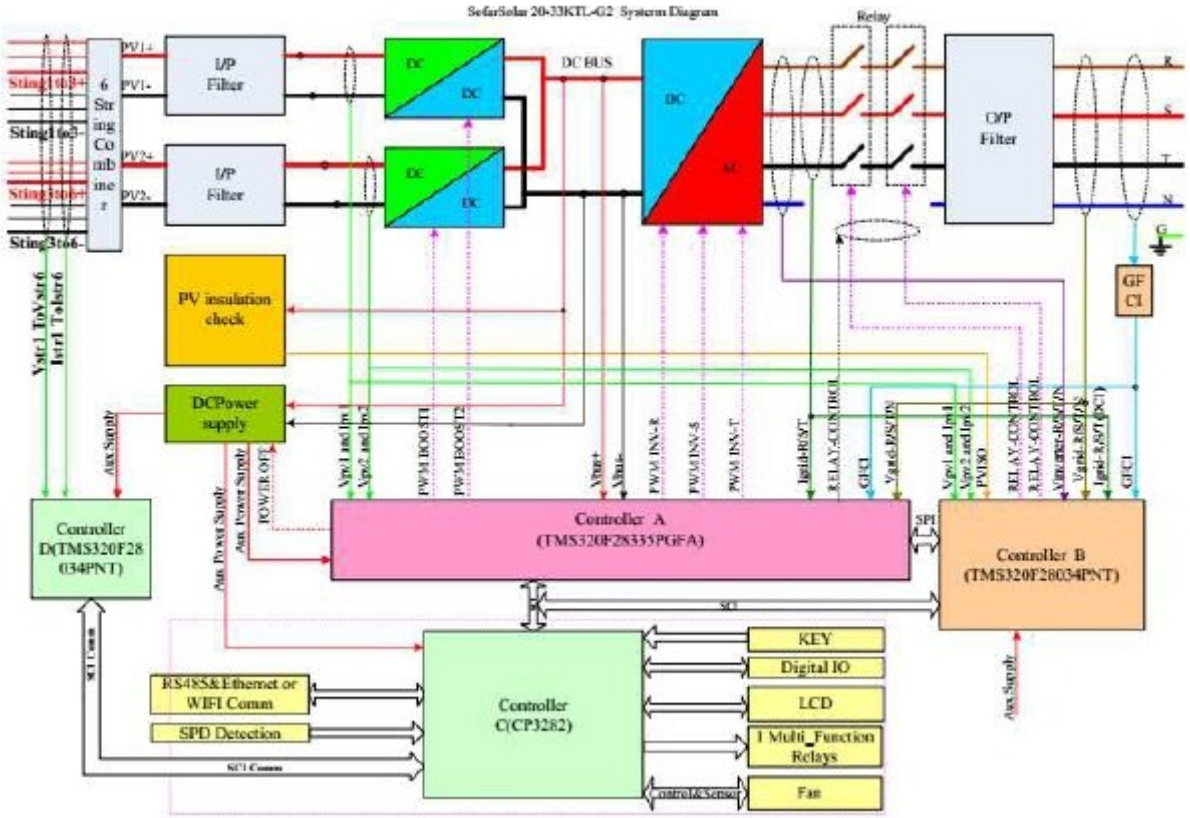
DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
4.8	**Requirements for disconnection devices integrated into PV-inverters**		P
	The requirements of the DIN EN 62109-2 (VDE 0126-14-2):2012-04, 4.8 regarding the residual current detection and the insulation detection of the PV-generator shall be complied with.		P
5	**General Requirements**		P
	Limits according to DIN EN 61000-6-3 (VDE 0839-6-3) regarding radio interferences must be complied with. For disturbance-free operation disturbance limits according to DIN EN 61000-6-2 (VDE 0839-6-2) shall be complied with.		P
6	**TYPE TESTING**		**P**
6.0	**General**		P
	The following tests are valid for integrated and separated disconnecting devices unless otherwise noted. A separate disconnection device must be tested together with a suitable supply. It has to be ensured that the turn-off signal is caused by the disconnection device and not by the supply.	See following test report	P
6.1	**Functional safety**		P
	The testing of the single fault tolerance and the error detection with following disconnection according to 4.1 is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.2.		P
6.2	**Connection conditions**		P
	The testing of the connection and the reconnection is carried out according to DIN VDE V 0124-100 (VDE V 0124):2012-07, 5.5.1 and 5.5.2.		P
6.3	**Monitoring the voltage**		P
	The testing of the voltage monitoring is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.3.		P
6.4	**Monitoring the frequency**		P
	The testing of the frequency monitoring is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.4.		P
6.5	**Monitoring the dc current**		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	The testing of the disconnection due to feed in of direct current is carried out either by a) or b): a) The measuring device at the switching point (e.g. current transformer or resistance) is fed with direct current of 1 A. The cut-off must be carried out within 0.2 seconds. b) By means of a fault simulation it is measured if a defective system operation with a d.c. fault current of more than 1 A leads to cut-off within 0.2 seconds.		P
6.6	**Detection of islanding operation**		P
	The testing of the disconnection due to unintended islanding operation is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.6.		P
7	**Routine Test**		**P**
	The manufacturer has to carry out routine tests regarding all safety relevant functions before delivering an automatic disconnection device.		P
8	**Construction Specification**		**P**
	Initial tests and re-examination in addition to the routine tests may be omitted. If the disconnection device is a separate unit it must not be used in a TN-C power system. In this case a TN-C-S power system must be created.		P

6.1 (5.4.5.1 & 5.4.5.2)	TABLE: General requirements	P

Design of functional safety:

The internal control is redundant built. It consists of Main DSP(UC20) and slave DSP(UC73).
The Main DSP(UC20) 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(UC73) is using for detect residual current, also can open the relays independently and communicate with Main DSP(UC20).
The unit provides two relays in series on Line 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(UC20), Slave DSP(UC73) can open the relays.



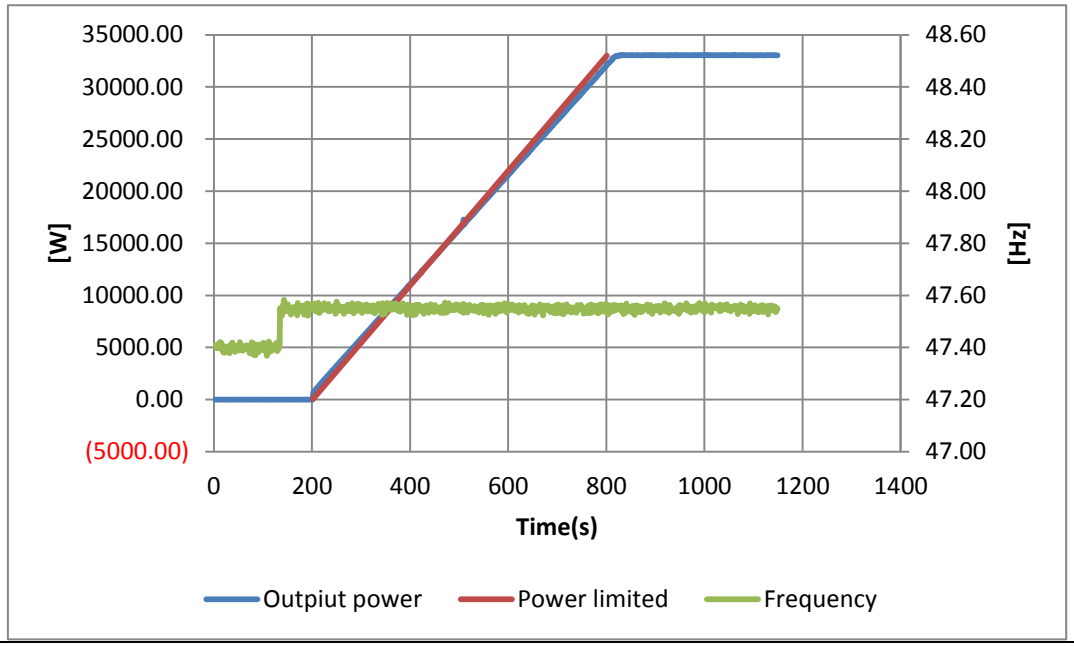
6.1 (6.5.1)			TABLE: General requirements				
String	1	U_{DC} = Un	850Vdc	Uac = Un	230 Vac	P = (W)	33000

Component No.	Fault	Observation
XLC2 Pin 2 to 3	Short	Inverter operated normally. No damaged.No hazards.
RB 137	Open	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
RB 139	Short	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.

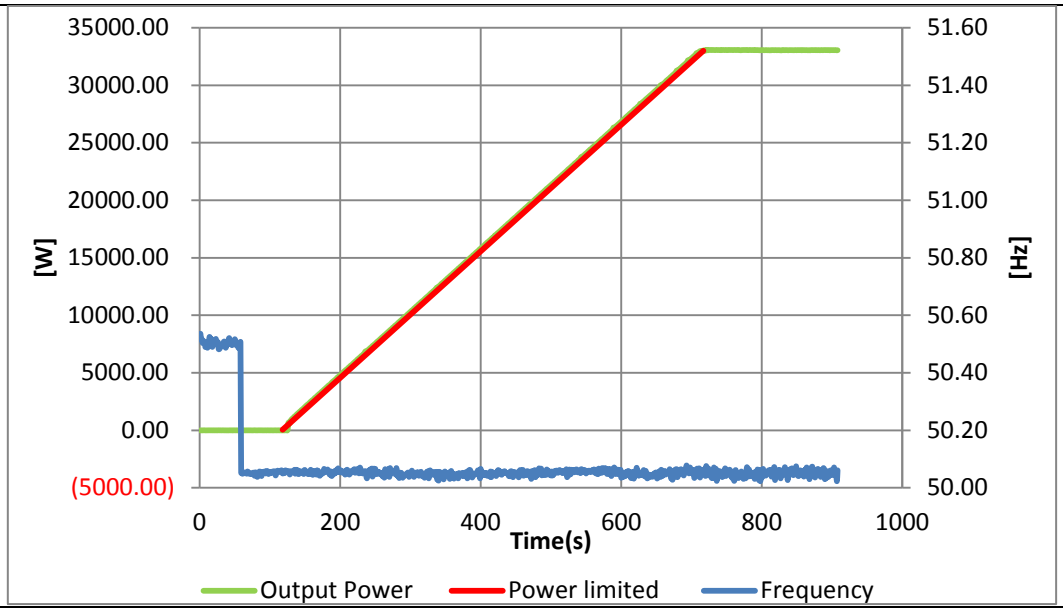
RB 131	Open	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
RB 122	Open	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
RB 110	Short	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
RB 96	Short	Inverter disconnected from grid immediately. Error message:"GFCI error". No damaged.No hazard.
RB 11	Open	Inverter disconnected from grid immediately. Error message:"GFCI error". No damaged.No hazard.
RB 8	Short	Inverter disconnected from grid immediately. Error message:"GFCI error". No damaged.No hazard.
UB1 PIN5 to 6	Short	Inverter disconnected from grid immediately. Error message:"GFCI error". No damaged.No hazard.
RB 23	Short	Inverter disconnected from grid immediately. Error message:"GFCI error". No damaged.No hazard.
QD1 PIN1 to 2	Short	Inverter disconnected from grid immediately. Error message:"The DCI overcurrent". No damaged.No hazard.
XLC2 PIN1 to 2	Short	Inverter disconnected from grid immediately. Error message:"The communication error". No damaged.No hazard.
DC 71	Short	Inverter disconnected from grid immediately. Error message:"The communication error". No damaged.No hazard.
U13 PIN2 to 3	Short	Inverter disconnected from grid immediately. Error message:"The communication error". No damaged.No hazard.
XLC1 PIN1 to 2	Short	Inverter did not start-up. Error message:"The SPI error"No damage.No hazard.
RC6	Short	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
RC19	Short	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
UC627 PIN2 to 3	Short	Inverter disconnected from grid immediately. Error message:" The grid voltage error". No damaged.No hazards.
UC637 PIN12 to 13	Short	Inverter disconnected from grid immediately. Error message:"GFCI error". No damaged.No hazard.
RC 167	Short before start-up	Inverter did not start-up.Error message:"The ISO error"No damage.No hazard.
RC 98	Short before start-up	Inverter did not start-up.Error message:"The ISO error"No damage.No hazard.

6.2 (5.5.1)	Connection conditions	P
For SOFAR 33000TL-G2		
DC input:	AC output:	Rated Output Power
850Vdc	230Vac; 50Hz	33000W
Measure Item	Reconnection?	Reconnection Time (>180s)
f_{ist} = 47,45Hz	☐ Yes ☒ No	Cannot reconnection
f_{ist} ≥ 47,55Hz	☒ Yes ☐ No	67.32s
f_{ist} = 50,1Hz	☐ Yes ☒ No	Cannot reconnection
f_{ist} ≤ 50,0Hz	☒ Yes ☐ No	66.15s
U_{ist} < 85% U_n	☐ Yes ☒ No	Cannot reconnection
U_{ist} ≥ 85% U_n	☒ Yes ☐ No	65.0s
U_{ist} > 110% U_n	☐ Yes ☒ No	Cannot reconnection
U_{ist} ≤ 110% U_n	☒ Yes ☐ No	65.0s

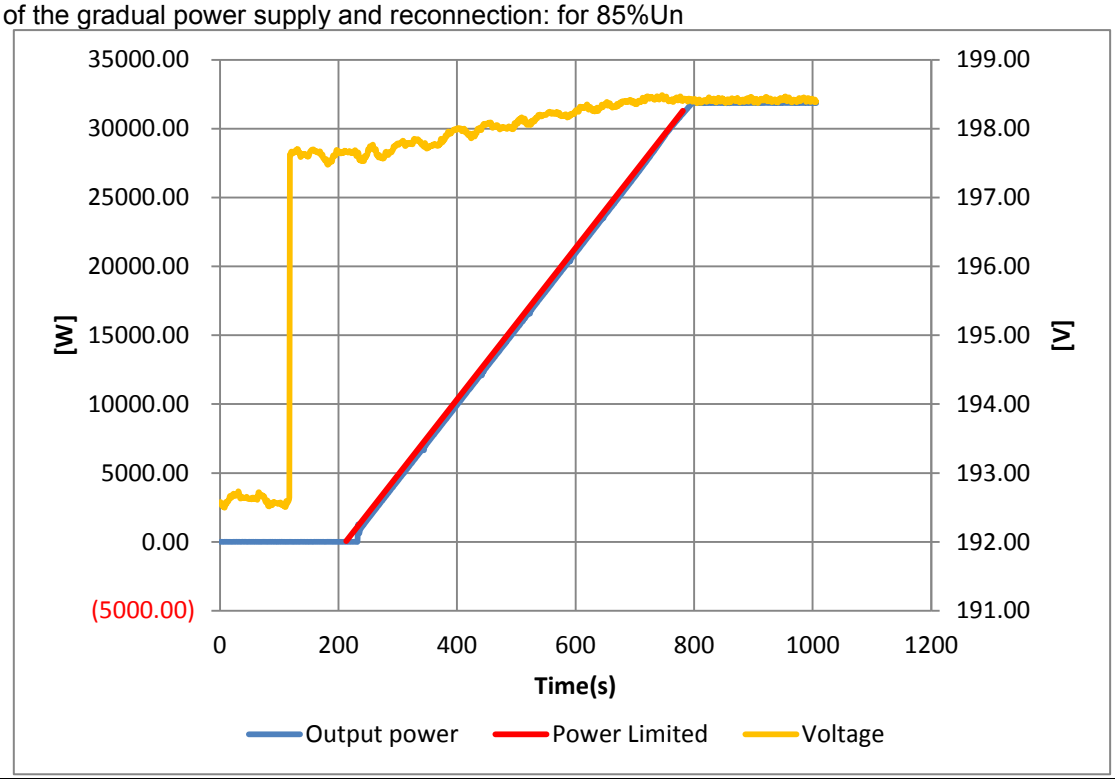
Graph of the gradual power supply and reconnection: for 47.55Hz



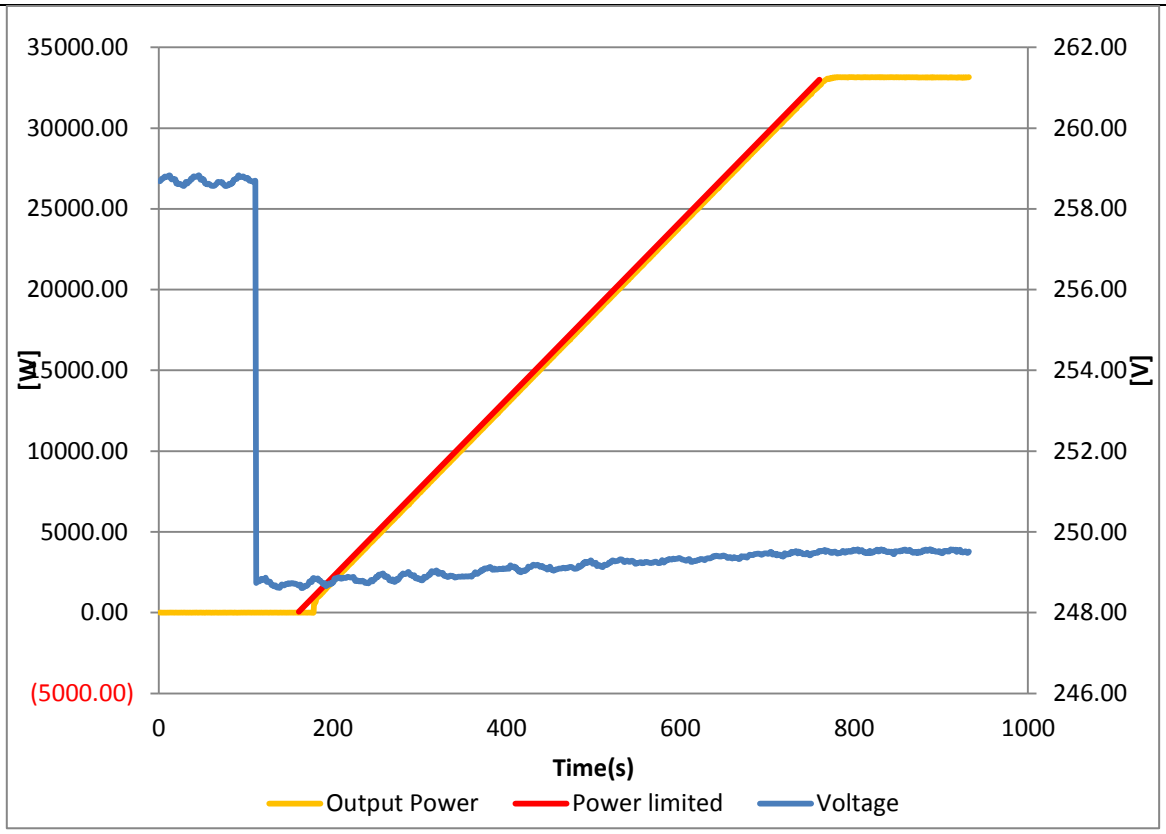
Graph of the gradual power supply and reconnection: for 50.0Hz



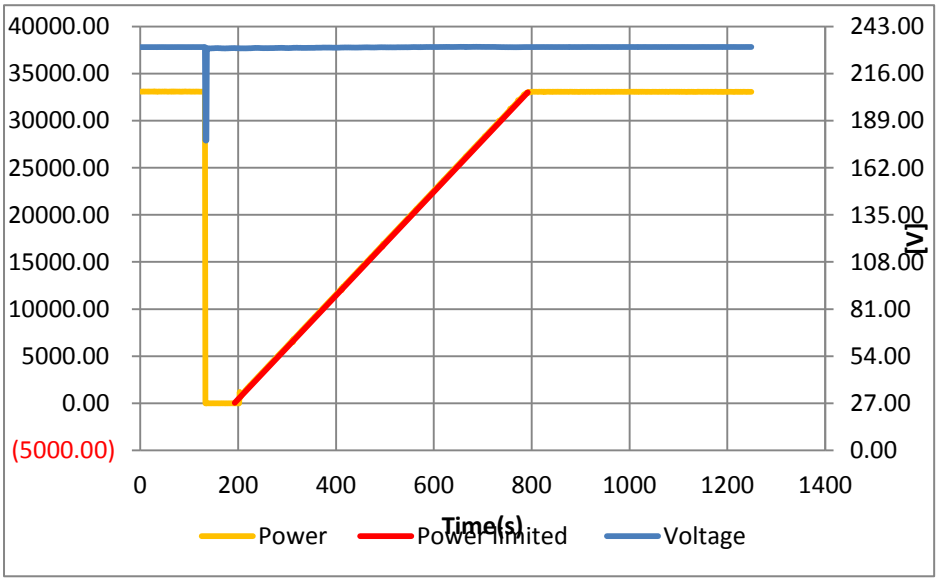
Graph of the gradual power supply and reconnection: for 85%Un



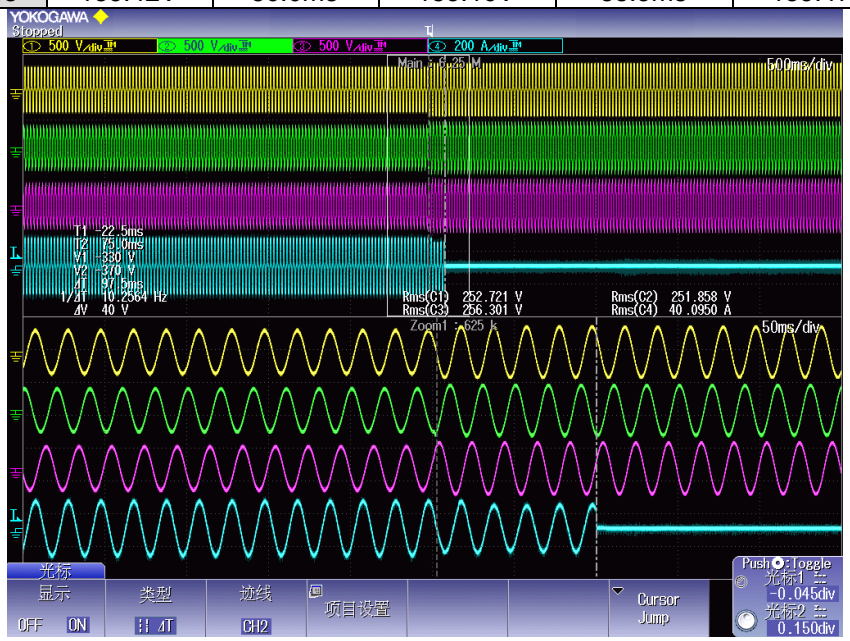
Graph of the gradual power supply and reconnection: for 110%Un



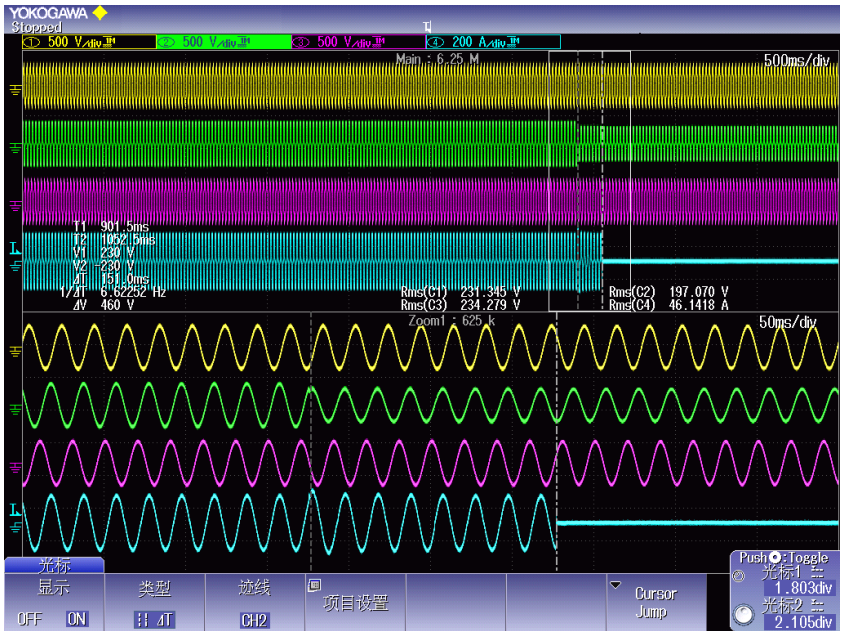
6.2 (5.5.2)	Short-time Interruption								P
	1			2			3		
	U_n (V)	Repeated Time (s)	Gradient (W/min)	U_n (V)	Repeated Time (s)	Gradient (W/min)	U_n (V)	Repeated Time (s)	Gradient (W/min)
After 2s of 77% Un	230	67.0	3292.95	230	65.0	3294.86	230	67.0	3292.09
After 4s of 77% Un	230	68.0	3292.13	230	67.0	3243.17	230	68.0	3248.50



6.3 (5.4.5.3)		Monitoring the voltage (Results of Voltage monitoring)					P
Rated Voltage (Un)		230Vac		Rated Frequency		50Hz	
		1		2		3	
118% Un	ALL	263.47V	97.5ms	263.68V	96.0ms	263.47V	95.5ms
	R phase	263.84V	96.0ms	262.18V	96.0ms	263.78V	96.0ms
	S phase	263.03V	96.0ms	263.01V	96.5ms	263.06V	96.0ms
	T phase	263.94V	97.0ms	262.77V	97.0ms	263.92V	97.0ms
77% Un	ALL	183.15V	97.0ms	183.01V	98.0ms	183.23V	94.5ms
	R phase	183.50V	150.0ms	183.51V	151.0ms	183.05V	150.5ms
	S phase	183.43V	149.0ms	183.48V	101.0ms	183.53V	146.0ms
	T phase	183.42V	86.0ms	183.16V	88.5ms	183.47V	87.5ms



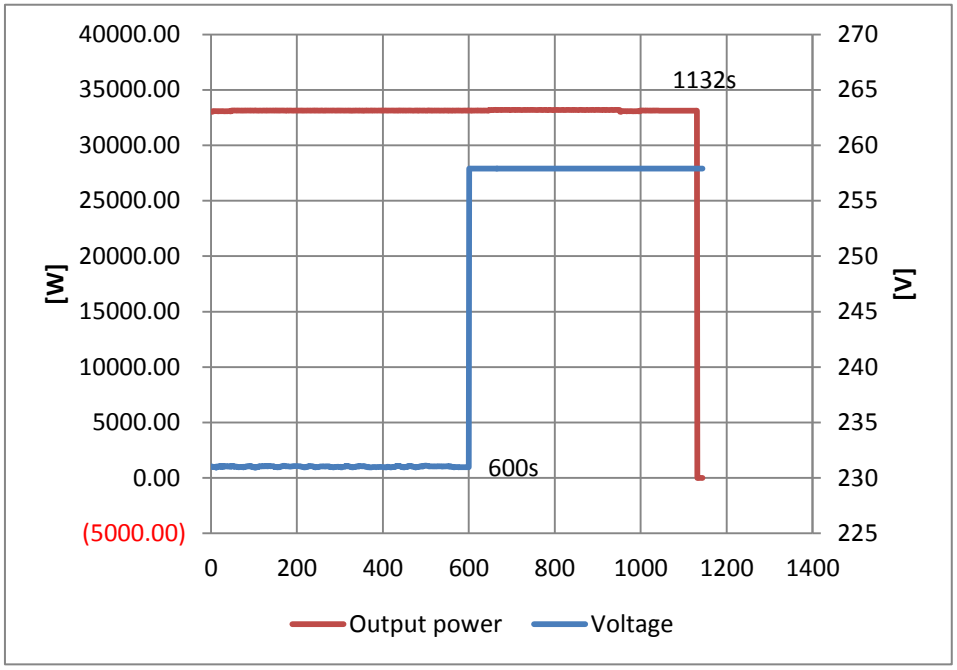
118% Un



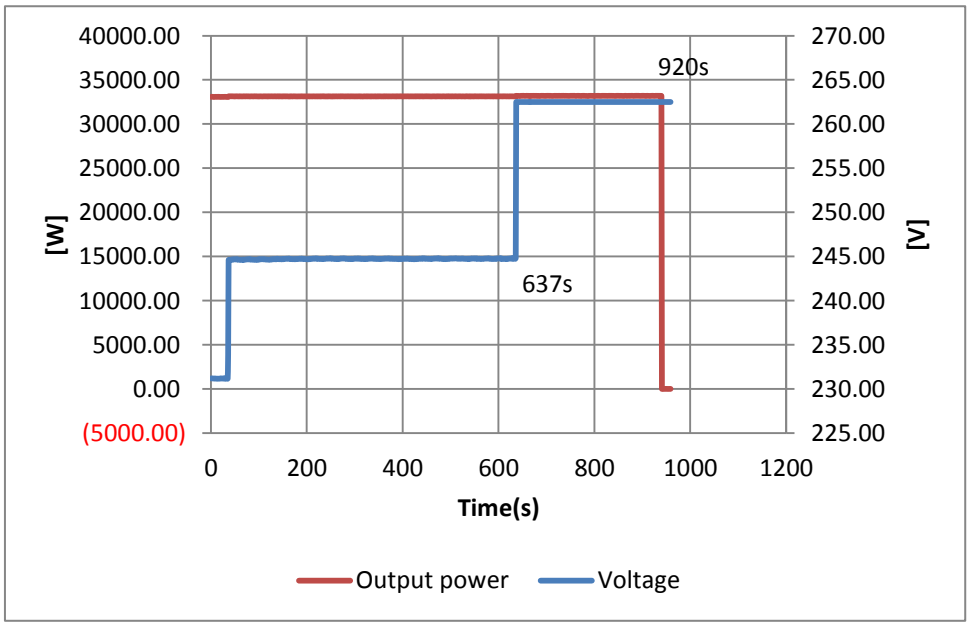
77% Un

Color Yellow, Green, Purple denotes Voltage of output, Blue denotes current of output

6.3 (5.4.5.3)	Monitoring the voltage (Results of the Protection of the Increase in Voltage as 10-min moving average)		P
	Output Voltage （V）	Switch	
		On/Off state Finally	Time until Switch off (s)
100% Un	230.0	☒On ☐Off	Work normally
112% Un	257.6	☐On ☒Off	532.0s
100% Un	230.0	☒On ☐Off	Work normally
108% Un	248.4	☒On ☐Off	Work normally
106% Un	243.8	☒On ☐Off	Work normally
114% Un	262.2	☐On ☒Off	283.0s



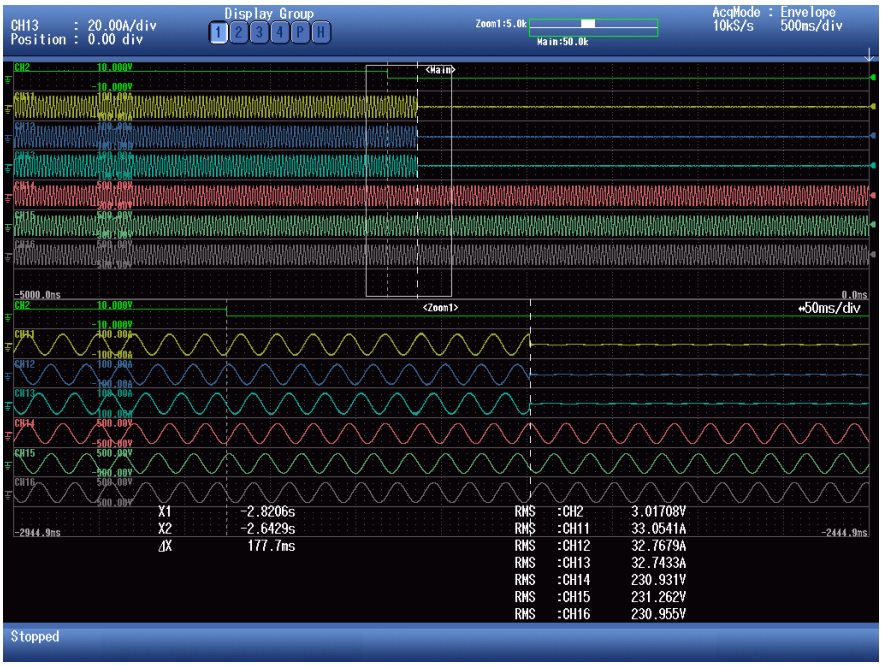
112% Un



114% Un

6.4 (5.4.5.4)	Monitoring the frequency (VFR 2014)					P
	1		2		3	
	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)
Frequency decrease	47.501	153.0	47.500	156.2	47.501	153.8
Frequency increase	50.602	163.7	50.601	177.7	50.601	175.2

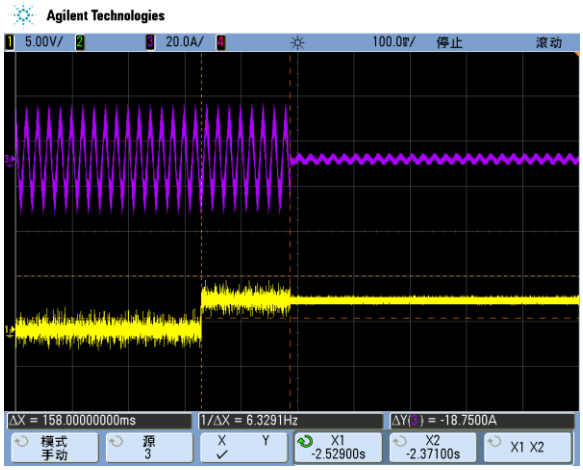
Frequency decrease

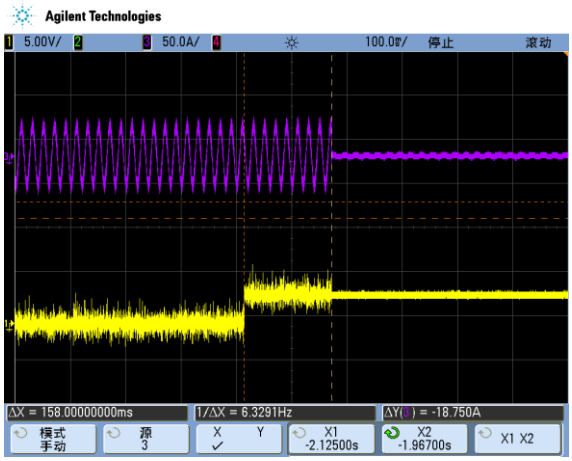


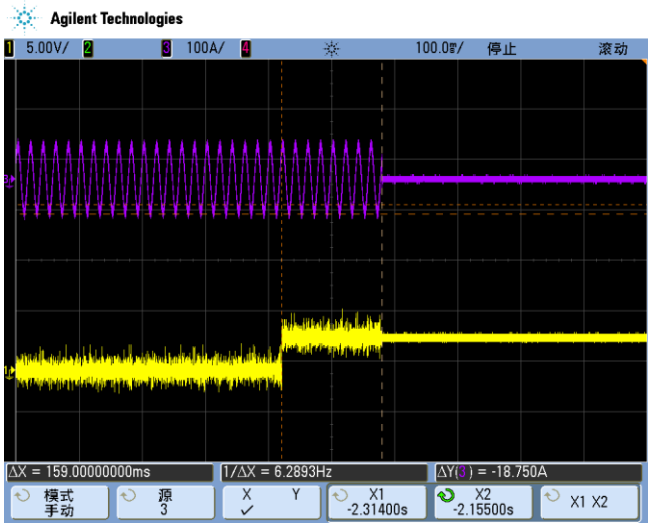
Frequency increase

Chanel CH14, CH15, CH16 denotes Voltage of output, CH11, CH12, CH13 denotes current of output, CH2 denotes trip signal.

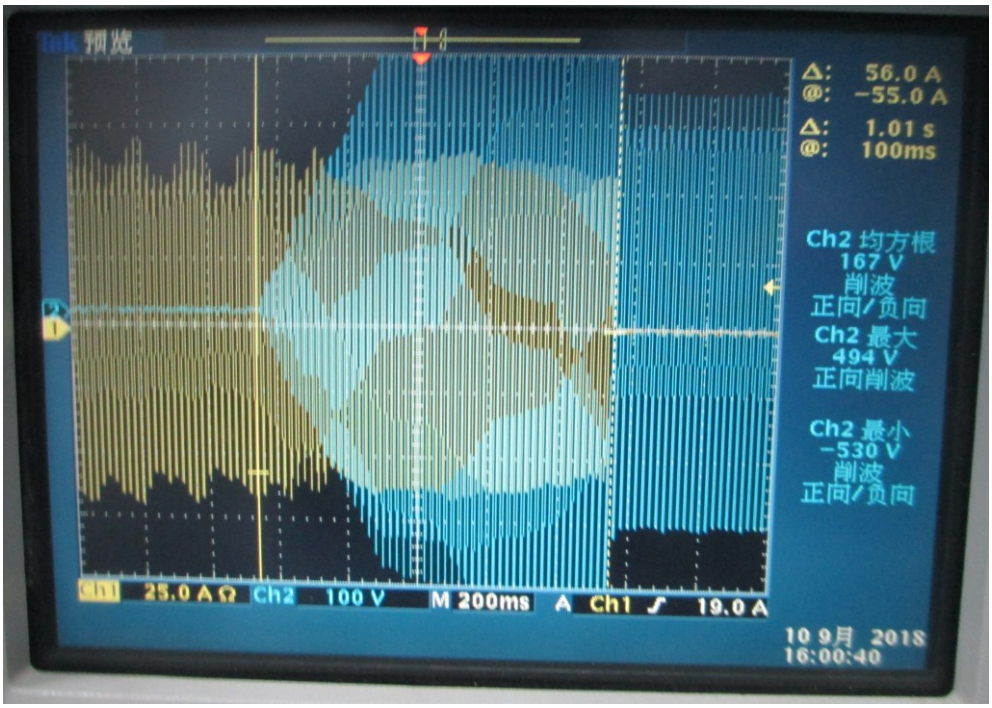
6.5	TABLE: Monitoring the dc current	P
P = 0.25 P_N= (W)	8250W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	158.0	
P = 0.5 P_N= (W)	16500W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	158ms	
P = 1.0 P_N= (W)	3300W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	159ms	



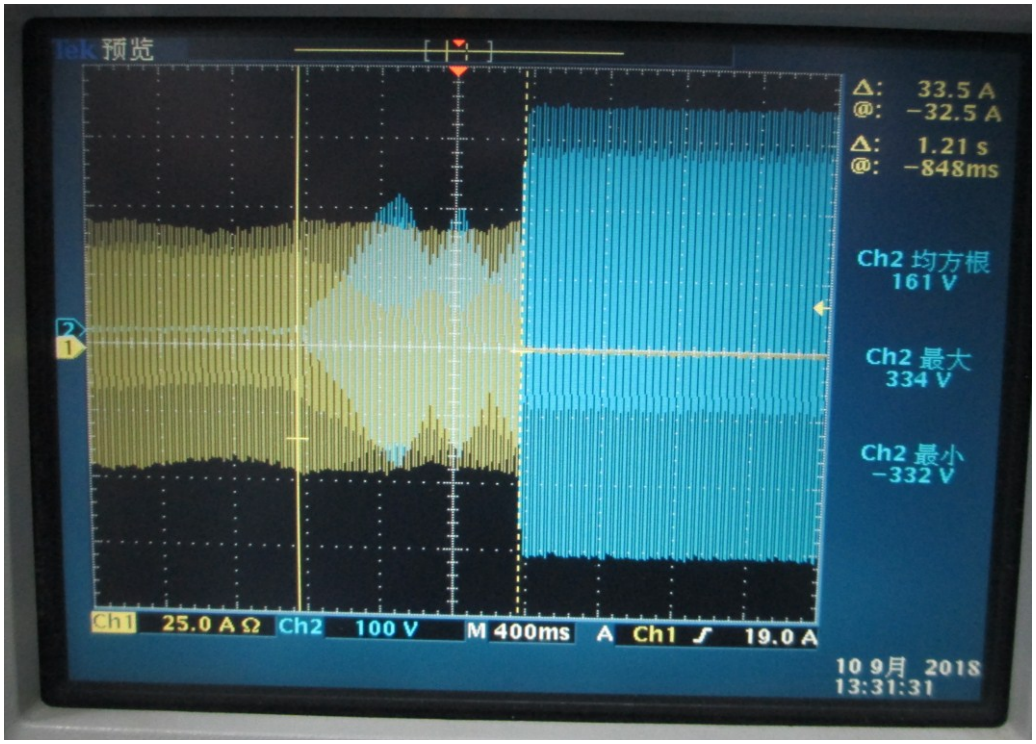




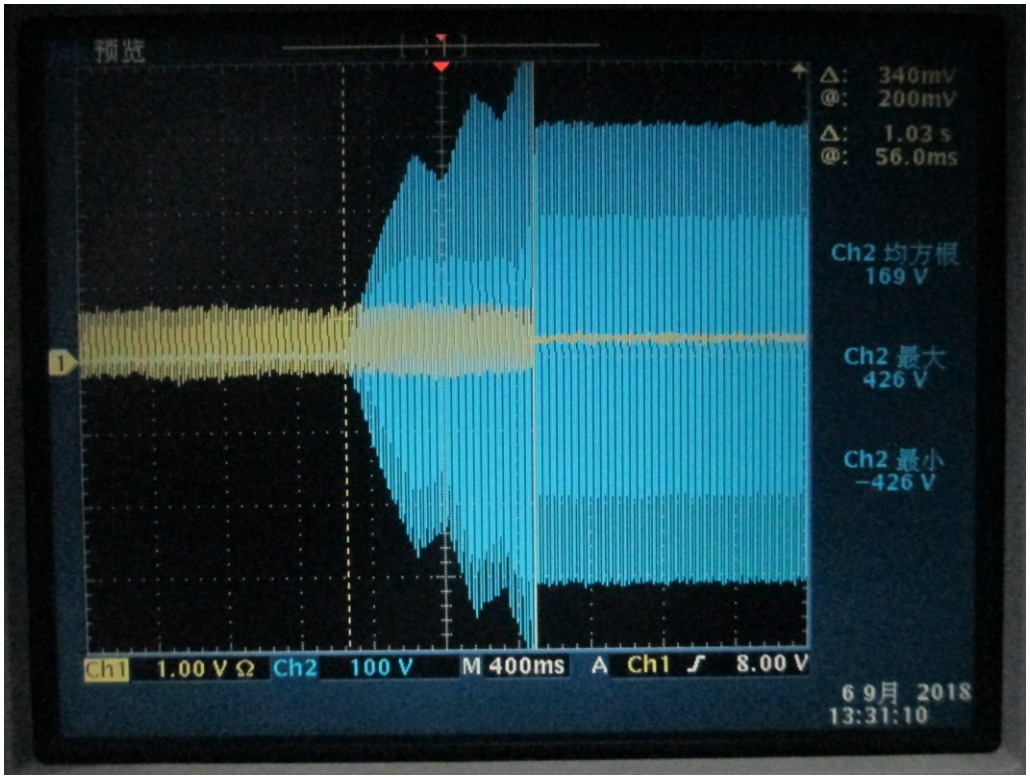
6.6 (5.4.6)	TABLE: Detection of islanding operation				P
Test conditions:	Frequency: 50+/-0,2Hz U_N=230+/-3Vac RLC consumes inverter real power within +/-3% Distortion factor of chokes <3% Quality Q>2				
P = 1.0 P_N = (W)	33000W	P = 0.5 P_N = (W)	16500W	P = 0.25 P_N = (W)	8250W
Q_L = 67.04KVar	Cut-off time (ms)	Q_L = 33.52KVar	Cut-off time (ms)	Q_L = 16.76KVar	Cut-off time (ms)
95%	920.0	95%	976	95%	128
96%	828.0	96%	992	96%	172
97%	980.0	97%	1210	97%	652
98%	920.0	98%	944	98%	920
99%	1010.0	99%	976	99%	960
100%	928.0	100%	1010	100%	1020
101%	964.0	101%	976	101%	896
102%	948.0	102%	912	102%	1030
103%	976.0	103%	568	103%	912
104%	944.0	104%	992	104%	976
105%	960.0	105%	580	105%	964



100%

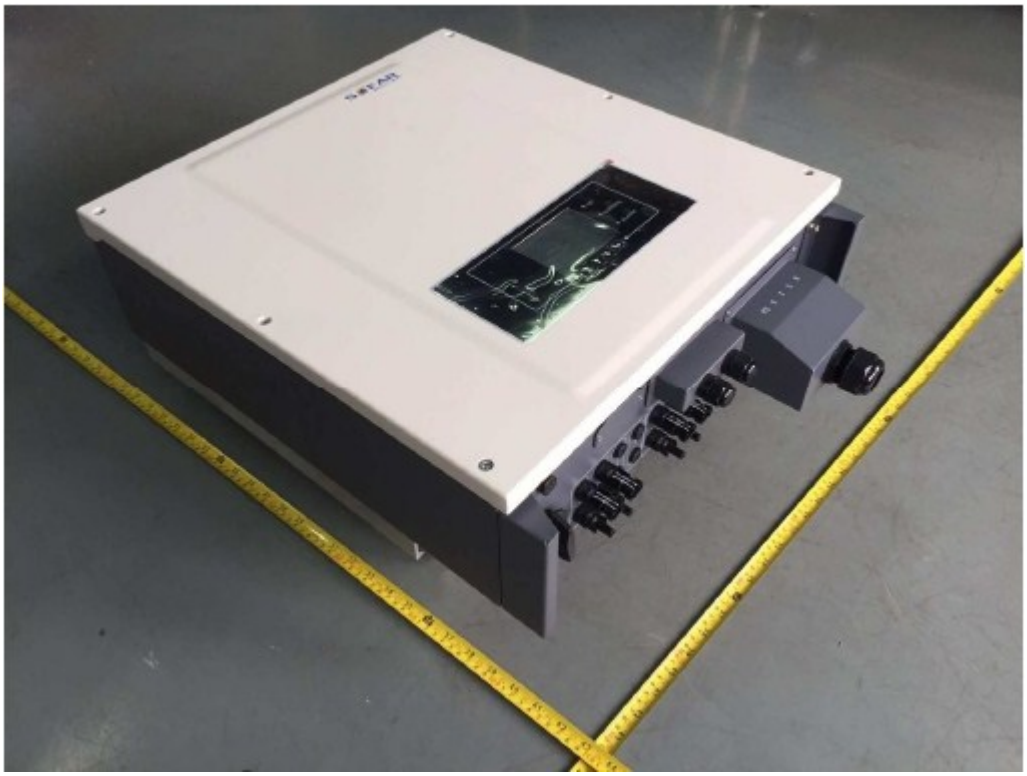


50%

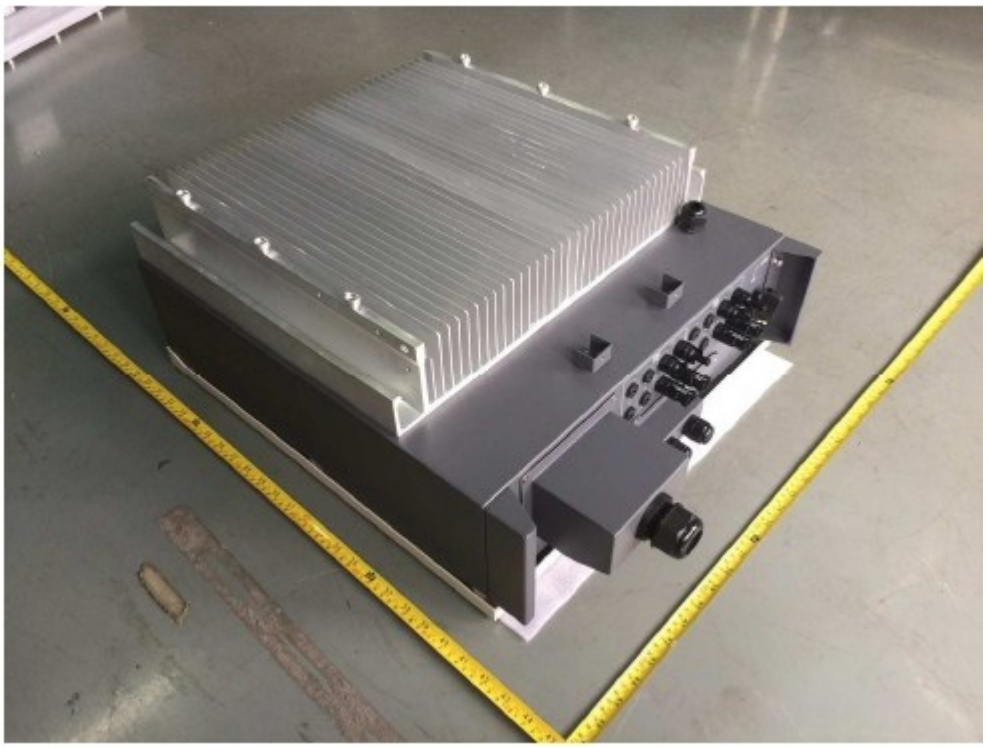


25%

Yellow: Current of output, Green: Trip signal

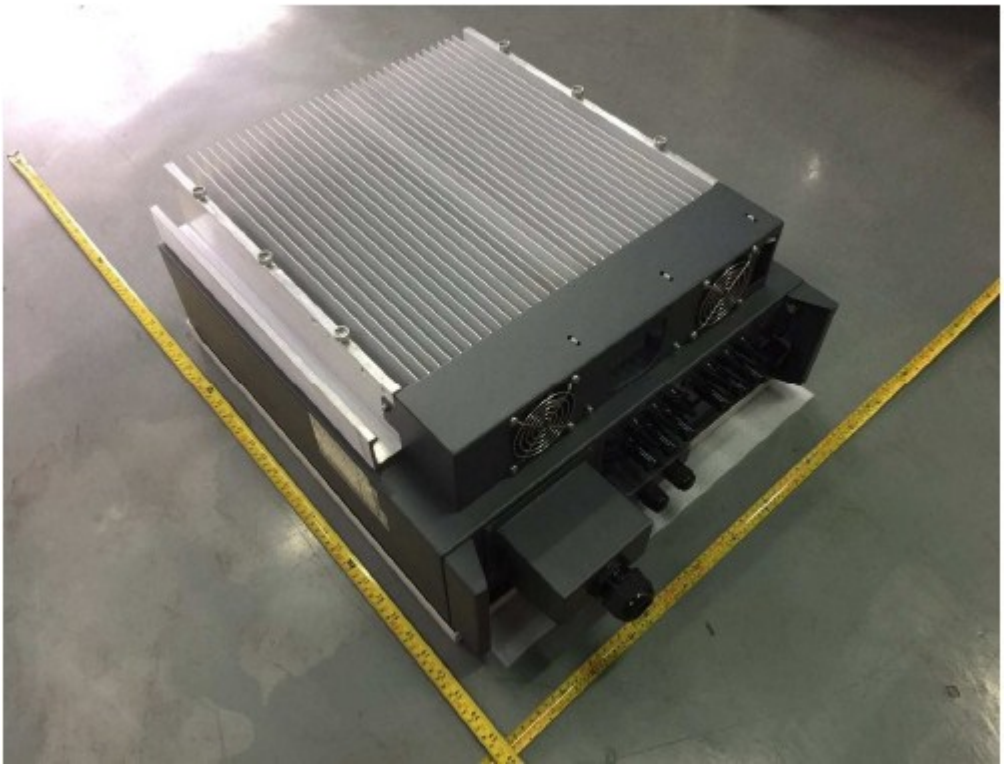


Enclosure front view: SOFAR 20000TL-G2



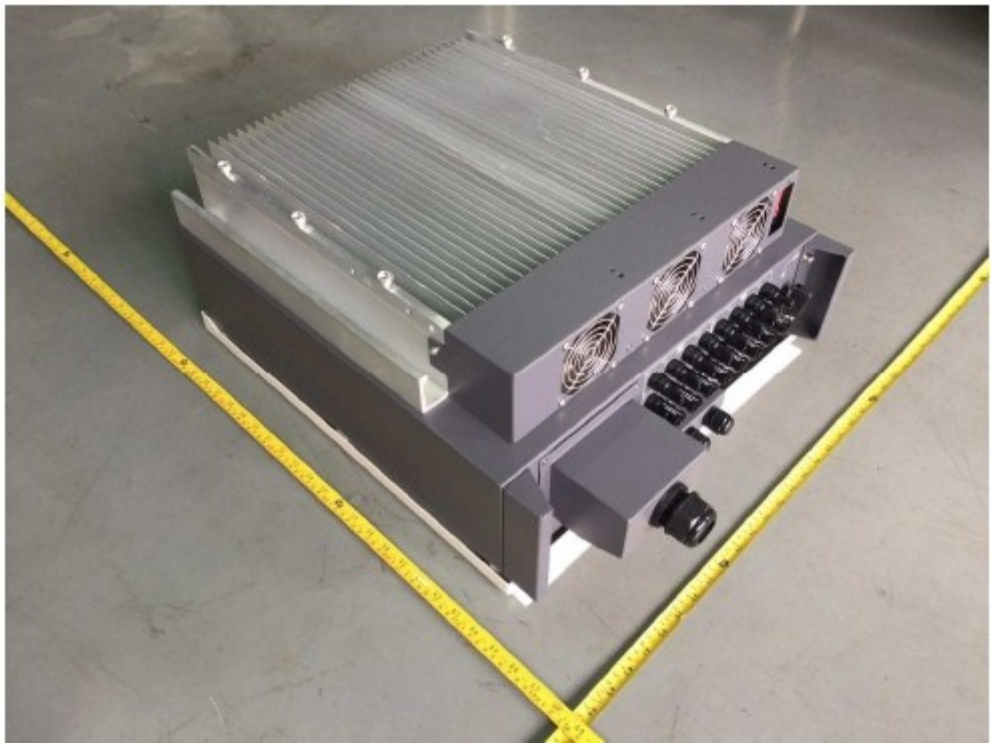
Enclosure rear view: SOFAR 20000TL-G2

Enclosure front view: SOFAR 25000TL-G2



Enclosure rear view: SOFAR 25000TL-G2

Enclosure front view: SOFAR 30000TL-G2, SOFAR 33000TL-G2



Enclosure rear view: SOFAR 30000TL-G2, SOFAR 33000TL-G2

Internal view: SOFAR 20000TL-G2

Internal view: SOFAR 25000TL-G2

Internal view: SOFAR 30000TL-G2, SOFAR 33000TL-G2

(End of report)