








**BUREAU
VERITAS**

TEST REPORT IEC 62116

Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters

Report reference number	PV190308N051-1			
Date of issue	2019-07-05			
Total number of pages	24			
Testing laboratory name	Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch			
Address	No. 34, Chenwulu Section, Guantai Rd., Houjie Town, Dongguan City, Guangdong 523942, China			
				
	Certificate # 2951.01			
Applicant's name	EVOLVE ENERGY GROUP CO., LIMITED			
Address	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK			
Test specification				
Standard	IEC 62116:2014			
Certificate	Certificate of compliance			
Test report form number	IEC 62116			
Master TRF	Bureau Veritas Consumer Products Services Germany GmbH			
Test item description	Solar Grid-tied Inverter			
Trademark				
Model / Type	EVVO 20000TLG23P, EVVO 25000TLG23P, EVVO 30000TLG23P, EVVO 33000TLG23P			
Ratings	EVVO 20000TLG23P	EVVO 25000TLG23P	EVVO 30000TLG23P	EVVO 33000TLG23P
Input DC voltage range [V]	230-1100			
Full load MPPT DC voltage range [V]:	480-850	460-850	520-850	580-850
Input DC current [A]	24/24	28/28	30/30	30/30
Output AC voltage [V]	400V, 3/N/PE, 50Hz			
Output AC current [A]	Max. 32	Max. 40	Max. 48	Max. 53
Output power [VA]	22000	27500	33000	36300
<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 http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions 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>				

Testing Location	Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Address	No. 34, Chenwulu Section, Guantai Rd., Houjie Town, Dongguan City, Guangdong 523942, China
Tested by (name and signature)	Dora Zhang 
Approved by (name and signature)	James Huang 
Manufacturer's name	EVOLVE ENERGY GROUP CO., LIMITED
Manufacturer address	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
Factory's name	Dongguan SOFAR SOLAR Co.,Ltd.
Factory address	1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City

Document History			
Date	Internal reference	Modification / Change / Status	Revision
2019-07-05	Dora Zhang	Initial report was written	--
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] : 37

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 : 2018-07-12
 Date(s) of performance of test : 2018-07-12 to 2018-08-01

General remarks:

The test result presented in this report relate only to the object(s) tested.
 This report must 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.

This is a copy test report, the test results refer to the original test report **PV180712N013-1** issued by Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch, dated on Aug. 03, 2018.

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

This Test Report consists of the following documents:

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

Copy of marking plate:

EVVO Solar Grid-tied Inverter

Model No:	EVVO 20000TLG23P
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	230~960V
Max. Input Current	24A/24A
Max. PV Isc	30A/30A
Nominal Grid Voltage	3/N/PE, 400Vac
Max. Output Current	3x32A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	20000W
Max. Output Power	22000VA
Power Factor	>0.99(adjustable +/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25°C~+60°C
Protection Class	Class I

Factory - Shenzhen China
 Manufacturer : EVOLVE ENERGY GROUP CO., LIMITED
 Address :RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
 Global Head Quarters
 371 Sidco Industrial Estate
 Chennai 600098 India
 VDE0126-1-1,VDE-AR-N4105,G99,IEC61727,
 IEC62116,UTE C15-712-1,AS4777



EVVO Solar Grid-tied Inverter

Model No:	EVVO 25000TLG23P
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	230~960V
Max. Input Current	28A/28A
Max. PV Isc	35A/35A
Nominal Grid Voltage	3/N/PE, 400Vac
Max. Output Current	3x40A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	25000W
Max. Output Power	27500VA
Power Factor	>0.99(adjustable +/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25°C~+60°C
Protection Class	Class I

Factory - Shenzhen China
 Manufacturer : EVOLVE ENERGY GROUP CO., LIMITED
 Address :RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
 Global Head Quarters
 371 Sidco Industrial Estate
 Chennai 600098 India
 VDE0126-1-1,VDE-AR-N4105,G99,IEC61727,
 IEC62116,UTE C15-712-1,AS4777



EVVO Solar Grid-tied Inverter

Model No:	EVVO 30000TLG23P
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	230~960V
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	50/60Hz
Nominal Output Power	30000W
Max. Output Power	33000VA
Power Factor	>0.99(adjustable +/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25°C~+60°C
Protection Class	Class I

Factory - Shenzhen China
 Manufacturer : EVOLVE ENERGY GROUP CO., LIMITED
 Address :RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
 Global Head Quarters
 371 Sidco Industrial Estate
 Chennai 600098 India
 VDE0126-1-1,VDE-AR-N4105,G99,IEC61727,
 IEC62116,UTE C15-712-1,AS4777



EVVO Solar Grid-tied Inverter

Model No:	EVVO 33000TLG23P
Max.DC Input Voltage	1100V
Operating MPPT Voltage Range	230~960V
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	50/60Hz
Nominal Output Power	33000W
Max. Output Power	36300VA
Power Factor	>0.99(adjustable +/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25°C~+60°C
Protection Class	Class I

Factory - Shenzhen China
 Manufacturer : EVOLVE ENERGY GROUP CO., LIMITED
 Address :RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK
 Global Head Quarters
 371 Sidco Industrial Estate
 Chennai 600098 India
 VDE0126-1-1,VDE-AR-N4105,G99,IEC61727,
 IEC62116,UTE C15-712-1,AS4777



General product information:

The Solar converter converts DC voltage into AC voltage.

The DC input of Solar converter can be supplied from PV array and Batteries.

The charging current to batteries only from PV array, battery management unit is integrated in External Energy storage.

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

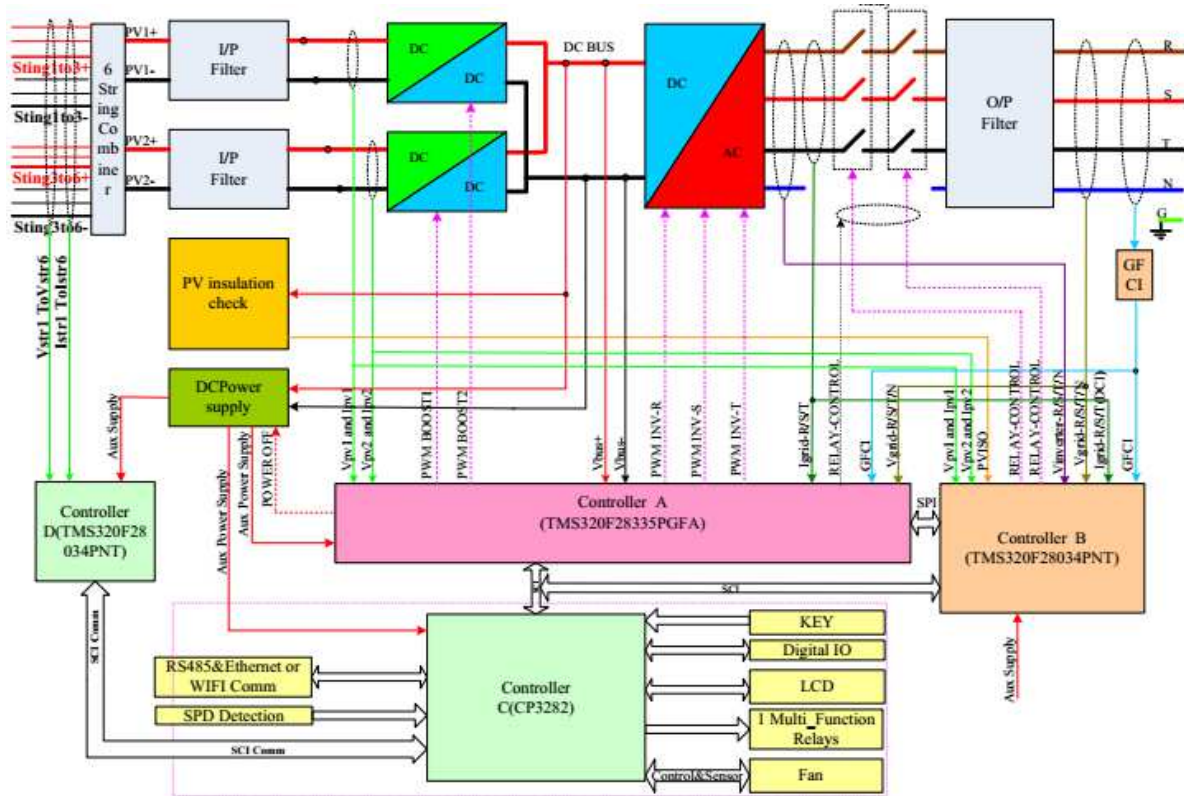


Figure 1-Block diagram

The internal control is redundant built. It consists of Main DSP (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 EVVO 20000TLG23P, EVVO 25000TLG23P, EVVO 30000TLG23P and EVVO 33000TLG23P are almost identical in hardware except the shown in the following table and the output power derated by software.

The difference in hardware			
Item	EVVO 20000TLG23P	EVVO 25000TLG23P	EVVO 30000TLG23P / EVVO 33000TLG23P
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	
BUS 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

IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict
4	Testing circuit		P
	The testing circuit shown in Figure 1 is employed.	Considered.	P
	Similar circuits are used for three-phase output.	Considered.	P
	Parameters to be measured are shown in Table 1 and Figure 1. Parameters to be recorded in the test report are discussed in Clause 7.	Considered.	P
5	Testing equipment		P
5.1	Measuring instruments		P
	The waveform measurement/capture device is able to record the waveform from the beginning of the islanding test until the EUT ceases to energize the island.	Considered.	P
	For multi-phase EUT, all phases are monitored.	Three phases are monitored.	P
	A waveform monitor designed to detect and calculate the run-on time may be used.	Oscilloscope is used.	P
	For multi-phase EUT, the test and measurement equipment is recorded each phase current and each phase-to-neutral or phase-to-phase voltage, as appropriate, to determine fundamental frequency active and reactive power flow over the duration of the test.	Considered.	P
	A sampling rate of 10 kHz or higher is recommended. The minimum measurement accuracy is 1 % or less of rated EUT nominal output voltage and 1 % or less of rated EUT output current	Considered.	P
	Current, active power, and reactive power measurements through switch S1 used to determine the circuit balance conditions report the fundamental (50 Hz or 60 Hz) component.	50Hz.	P
5.2	DC power source		P
5.2.1	General		P
	A PV array or PV array simulator (preferred) may be used. If the EUT can operate in utility-interconnected mode from a storage battery, a DC power source may be used in lieu of a battery as long as the DC power source is not the limiting device as far as the maximum EUT input current is concerned.	PV array simulator is used.	P
	The DC power source provides voltage and current necessary to meet the testing requirements described in Clause 6.	Considered.	P
5.2.2	PV array simulator		P
	The tests are conducted at the input voltage defined in Table 2 below, and the current is limited to 1,5 times the rated photovoltaic input current, except when specified otherwise by the test requirements.	Considered.	P
	A PV array simulator is recommended, however, any type of power source may be used if it does not influence the test results.	PV array simulator is used.	P
5.2.3	Current and voltage limited DC power supply with series resistance	PV array simulator is used.	N/A
	A DC power source used as the EUT input source is capable of EUT maximum input power (so as to achieve EUT maximum output power) at minimum and maximum EUT input operating voltage.		N/A

IEC 62116													
Clause	Requirement + Test	Result - Remark	Verdict										
	The power source provides adjustable current and voltage limit, set to provide the desired short circuit current and open circuit voltage when combined with the series and shunt resistance described below.		N/A										
	A series resistance (and, optionally, a shunt resistance) is selected to provide a fill factor within the range: Output power: Sufficient to provide maximum EUT output power and other levels specified by test conditions of table 5. Response speed: The response time of a simulator to a step in output voltage, due to a 5% load change, results in a settling of the output current to within 10% of its final value in less than 1ms. Stability: Excluding the variations caused by the EUT MPPT, simulator output power remains stable within 2 % of specified power level over the duration of the test: from the point where load balance is achieved until the island condition is cleared or the allowable run-on time is exceeded. Power factor: 0.25 to 0.8		N/A										
5.2.4	PV array	PV array simulator is used.	N/A										
	A PV array used as the EUT input source is capable of EUT maximum input power at minimum and maximum EUT input operating voltage.		N/A										
	Testing is limited to times when the irradiance varies by no more than 2 % over the duration of the test as measured by a silicon-type pyranometer or reference device. It may be necessary to adjust the array configuration to achieve the input voltage and power levels prescribed in 6.1.		N/A										
5.3	AC power source		P										
	The utility grid or other AC power source may be used as long as it meets the conditions specified in Table 4. <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Table 4 – AC power source requirements</caption> <thead> <tr> <th>Items</th> <th>Conditions</th> </tr> </thead> <tbody> <tr> <td>Voltage</td> <td>Nominal ±2,0 %</td> </tr> <tr> <td>Voltage THD</td> <td>< 2,5 %</td> </tr> <tr> <td>Frequency</td> <td>Nominal ±0,1 Hz</td> </tr> <tr> <td>Phase angle distance ¹⁾</td> <td>120 ° ± 1,5 °</td> </tr> </tbody> </table> ¹⁾ Three-phase case only	Items	Conditions	Voltage	Nominal ±2,0 %	Voltage THD	< 2,5 %	Frequency	Nominal ±0,1 Hz	Phase angle distance ¹⁾	120 ° ± 1,5 °	Considered.	P
Items	Conditions												
Voltage	Nominal ±2,0 %												
Voltage THD	< 2,5 %												
Frequency	Nominal ±0,1 Hz												
Phase angle distance ¹⁾	120 ° ± 1,5 °												
5.4	AC loads		P										
	On the AC side of the EUT, variable resistance, capacitance, and inductance are connected in parallel as loads between the EUT and the AC power source. Other sources of load, such as electronic loads, may be used if it can be shown that the source does not cause results that are different than would be obtained with passive resistors, inductors, and capacitors.	Considered.	P										

IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict
	All AC loads are rated for and adjustable to all test conditions. The equations for Qf are based upon an ideal parallel RLC circuit. For this reason, non-inductive resistors, low loss (high Qf) inductors, and capacitors with low effective series resistance and effective series inductance are utilized in the test circuit. Iron core inductors, if used, are not exceed a current THD of 2 % when operated at nominal voltage. Load components are conservatively rated for the voltage and power levels expected. Resistor power ratings are chosen so as to minimize thermally-induced drift in esistance values during the course of the test.	Considered.	P
	Active and reactive power is calculated (using the measurements provided in Table 1) in each of the R, L and C legs of the load so that these parasitic parameters (and parasitics introduced by variacs or autotransformers) are properly accounted for when calculating Qf.	Considered.	P
6	Test for single or multi-phase inverter		P
6.1	Test procedure	(see appended table)	P
	The test uses an RLC load, resonant at the EUT nominal frequency (50 Hz or 60 Hz) and matched to the EUT output power.		P
	For multi-phase EUT, the load is balanced across all phases and the switch S1 as in Figure 1 opens all phases	The switch could open all phases.	P
	This test is performed with the EUT conditions as in Table 5, where power and voltage values are given as a percent of EUT full output rating.	(see appended table)	P
	a)..Determine EUT test output power	Considered.	P
	b) .Adjusting the DC input source	Considered.	P
	c) .Turn off the EUT and open S1	Considered.	P
	d) .Adjust the RLC circuit to have $Q_f = 1.0 \pm 0.05$	Considered.	P
	e)..Connect the RLC load configured in step d) to the EUT by closing S2	Considered.	P
	f)...Open the utility-disconnect switch S1 to initiate the test, Run-on time is recorded.	Considered.	P
	g)..For test condition A, adjust the real load and only one of the reactive load components to each of the load imbalance conditions shown in the shaded portion of table 6. If any of the recorded run-on times are longer than the one recorded for the rated balance condition, then the non-shaded parameter combinations also require testing.	Considered.	P
	h) For test condition B and C, adjust the only one reactive load components by approximately 1,0% per test, within a total range of 95% to 105% of the operating point. If run-on times are still increasing at the 95% or 105% points, additional 1% increments have to be taken until run-on times begin decreasing.	Considered.	P
6.2	Pass/fail criteria		P

IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict
	An EUT is considered to comply with the requirements for islanding protection when each case of recorded run-on time is less than 2 s or meets the requirements of local codes.	(see appended table)	P
7	Documentation		P
	At a minimum, the following information is recorded and maintained in the test report.	See below.	P
	a) Specifications of EUT. Table 8 provides an example of the type of information that is provided.	See label.	P
	b) Measurement results. Table 9 provides an example of the type of information that is provided. Actual measured values is to be recorded.	(see appended table)	P
	c) Block diagram of test circuit.	(see appended table)	P
	d) Specifications of the test and measurement equipment. Table 10 provides an example of the type of information that is provided.	Considered.	P
	e) Any test configuration or procedure details such as methods of achieving specified load and EUT output conditions.	(see appended table)	P
	f) Any additional information required by the testing laboratory's accreditation.	(see appended table)	P
	g) Specify the evaluation criterion from clause 6.2 that was utilized to determine if the product passed or failed the test.	(see appended table)	P
Annex A	Islanding as it applies to PV systems(Informative)		P
A.1	General	Type test.	N/A
A.2	Impact of distortion on islanding	Considered.	P
Annex B	Test for independent islanding detection device (relay)(Informative)		N/A
B.1	Introduction	Grid-interactive inverter.	N/A
B.2	Testing circuit	Grid-interactive inverter.	N/A
B.3	Testing equipment	Grid-interactive inverter.	N/A
B.4	Testing procedure	Grid-interactive inverter.	N/A
B.5	Documentation	Grid-interactive inverter.	N/A

IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict

Test overview:		
IEC 62116:2014		
Clause	Test	Result
	Type test:	
6.1	Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT output = 100%)	P
6.1	Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	P
6.1	Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	P

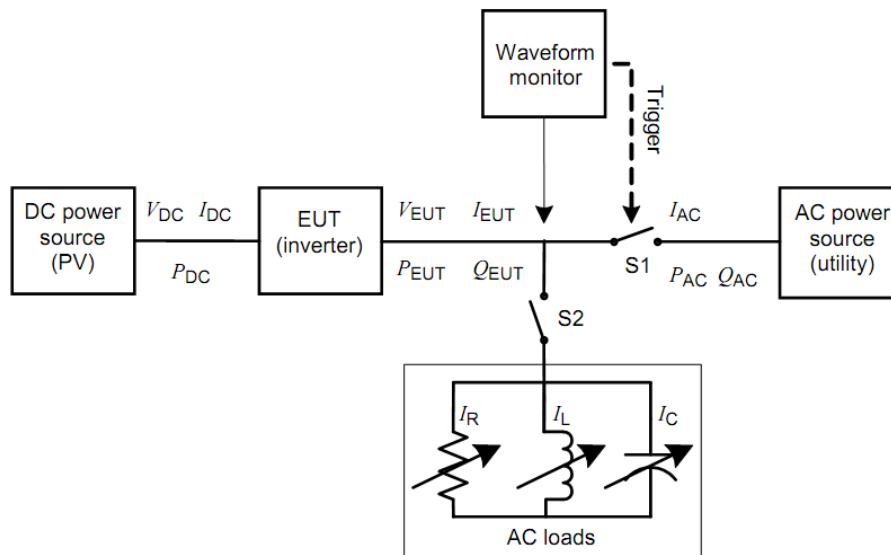
IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict

6.1 Islanding protection

Test circuit and parameters

Parameter	Symbol	Units
EUT DC Input		
DC voltage	V_{DC}	V
DC Current	I_{DC}	A
DC Power	P_{DC}	W
EUT AC output		
AC voltage	V_{EUT}	V
AC current	I_{EUT}	A
Real power	P_{EUT}	W
Reactive power	Q_{EUT}	VAR
Test Load		
Resistive load current	I_R	A
Inductive load current	I_L	A
Capacitive load current	I_C	A
AC (utility) power source		
Utility real power	P_{AC}	W
Utility reactive power	Q_{AC}	VAR
Utility current	I_{AC}	A

Block diagram test circuit IEC 62116:2008



IEC 1567/08

Figure 1 – Test circuit for islanding detection function in a power conditioner (inverter)

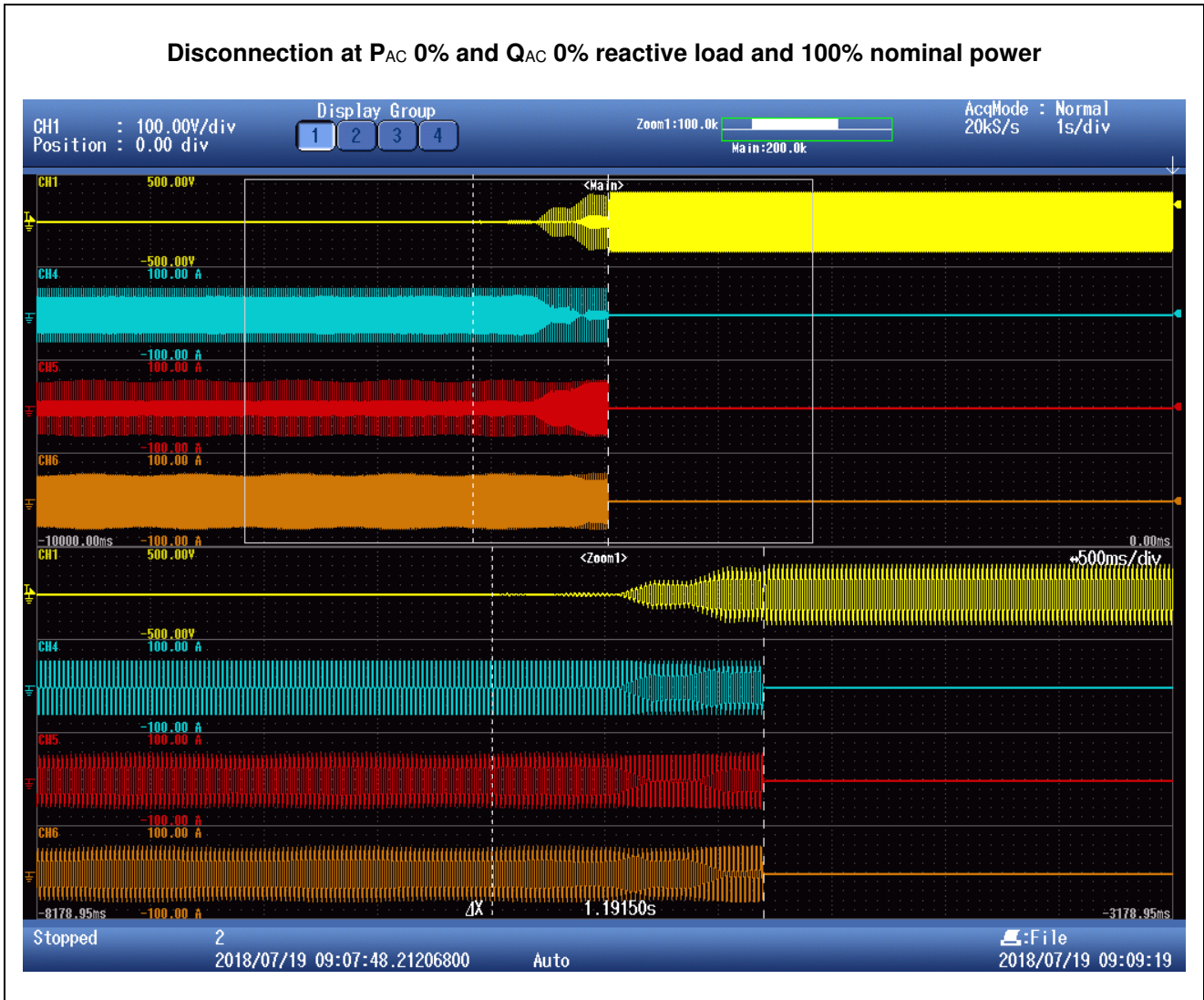
IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict

6.1 Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT output = 100%)										P
Test conditions		Frequency: 50+/-0.1Hz U _N =230+/-3Vac Distortion factor of chokes < 2% Quality = 1								
Disconnection limit		2s								
No	P _{EUT} ¹⁾ [% of EUT rating]	Reactive load [% of Q _L in 6.1.d) 1]	P _{AC} ²⁾ [% of nominal]	Q _{AC} ³⁾ [% of nominal]	I _{AC} ⁴⁾ [A]	P _{EUT} [W per phase]	V _{DC} [V]	Q _f [1]	Run on Time [ms]	Remarks ⁵⁾
1	100	100	0	0	0.138	11320	718	1.004	1192	BL
4	100	100	-5	-5	0.838	11320	718	1.030	590	IB
5	100	100	-5	0	0.860	11320	718	1.056	1021	IB
6	100	100	-5	+5	0.843	11320	718	1.082	115	IB
7	100	100	0	-5	0.159	11320	718	0.978	383	IB
8	100	100	0	+5	0.154	11320	718	1.028	95	IB
9	100	100	+5	-5	0.879	11320	718	0.932	545	IB
10	100	100	+5	0	0.860	11320	718	0.956	1074	IB
11	100	100	+5	+5	0.875	11320	718	0.979	103	IB
Parameter at 0%		L= 14.81 mH		R= 4.67 Ω		C= 683.13 μF				
<p>Note: RLC is adjusted to min. +/-1% of the inverter rated output power 1) P_{EUT}: EUT output power 2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value. 3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value. 4) Fundamental of I_{AC} when RLC is adjusted 5) BL: Balance condition, IB: Imbalance condition.</p> <p>Condition A: EUT output power P_{EUT} = Maximum⁶⁾ EUT input voltage⁶⁾ = >75% of rated input voltage range</p> <p>⁶⁾ Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output. ⁷⁾ Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 75 % of range = X + 0,75 × (Y - X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.</p>										

IEC 62116

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

Disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 100% nominal power



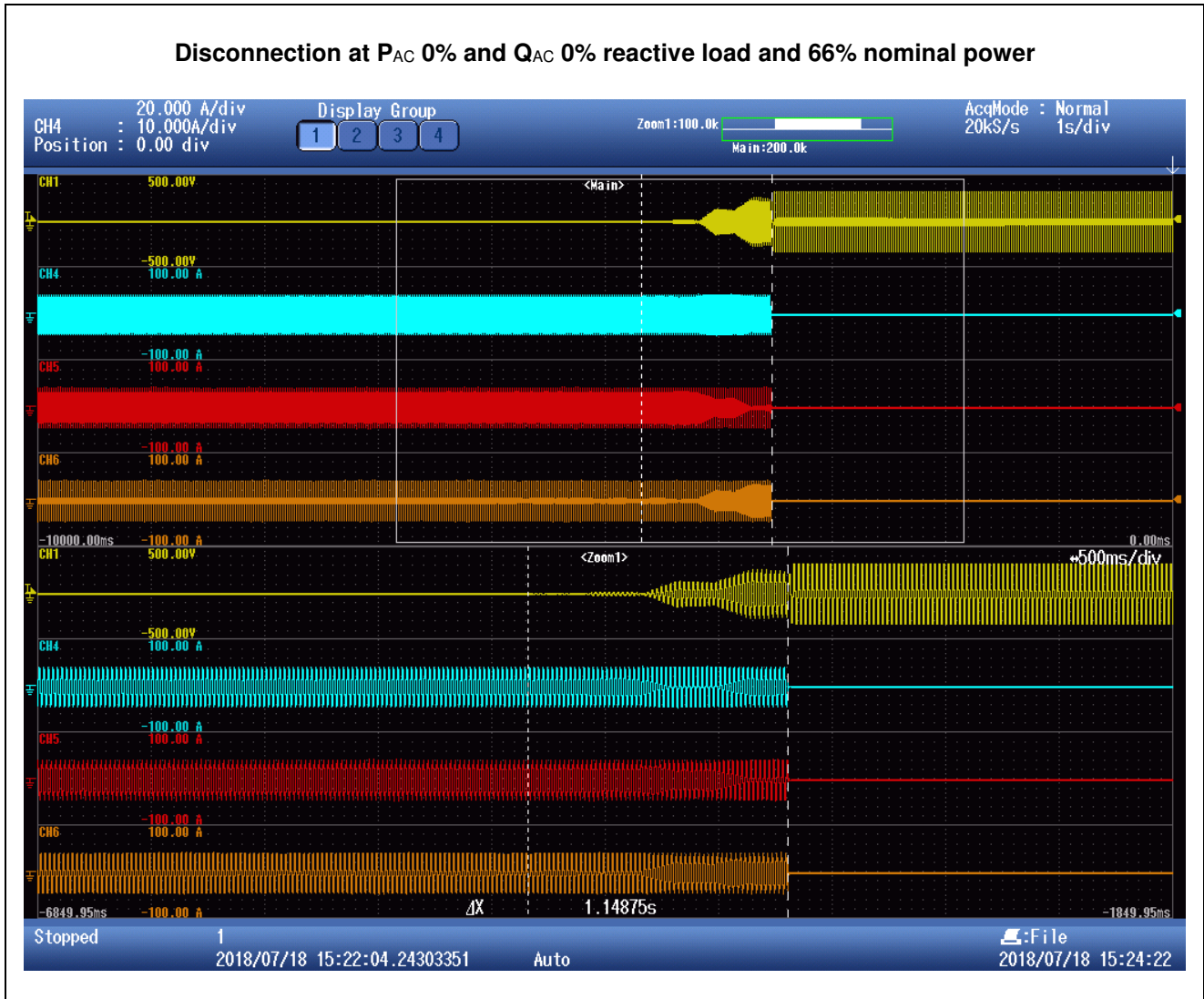
IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict

6.1 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)										P
Test conditions			Frequency: 50+/-0.1Hz U _N =230+/-3Vac Distortion factor of chokes < 2% Quality =1							
Disconnection limit			2s							
No	P _{EUT} ¹⁾ [% of EUT rating]	Reactive load [% of Q _L in 6.1.d) 1]	P _{AC} ²⁾ [% of nominal]	Q _{AC} ³⁾ [% of nominal]	I _{AC} ⁴⁾ [A]	P _{EUT} [W per phase]	V _{DC} [V]	Q _f [1]	Run on Time [ms]	Remarks ⁵⁾
12	66	66	0	-5	0.173	6700	555	0.977	395	IB
13	66	66	0	-4	0.168	6700	555	0.982	971	IB
14	66	66	0	-3	0.164	6700	555	0.987	994	IB
15	66	66	0	-2	0.161	6700	555	0.992	554	IB
16	66	66	0	-1	0.159	6700	555	0.997	962	IB
2	66	66	0	0	0.158	6700	555	1.002	1149	BL
17	66	66	0	1	0.158	6700	555	1.007	952	IB
18	66	66	0	2	0.159	6700	555	1.012	174	IB
19	66	66	0	3	0.161	6700	555	1.017	140	IB
20	66	66	0	4	0.164	6700	555	1.022	128	IB
21	66	66	0	5	0.167	6700	555	1.027	126	IB
Parameter at 0%			L= 25.09 mH		R= 7.90 Ω			C= 404.36 μF		
Note: RLC is adjusted to min. +/-1% of the inverter rated output power 1) P _{EUT} : EUT output power 2) P _{AC} : Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value. 3) Q _{AC} : Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value. 4) Fundamental of I _{AC} when RLC is adjusted 5) BL: Balance condition, IB: Imbalance condition. Condition B: EUT output power P _{EUT} = 50 % – 66 % of maximum EUT input voltage ⁶⁾ = 50 % of rated input voltage range, ±10 % ⁶⁾ Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 50 % of range = X + 0,5 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.										

IEC 62116

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

Disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 66% nominal power



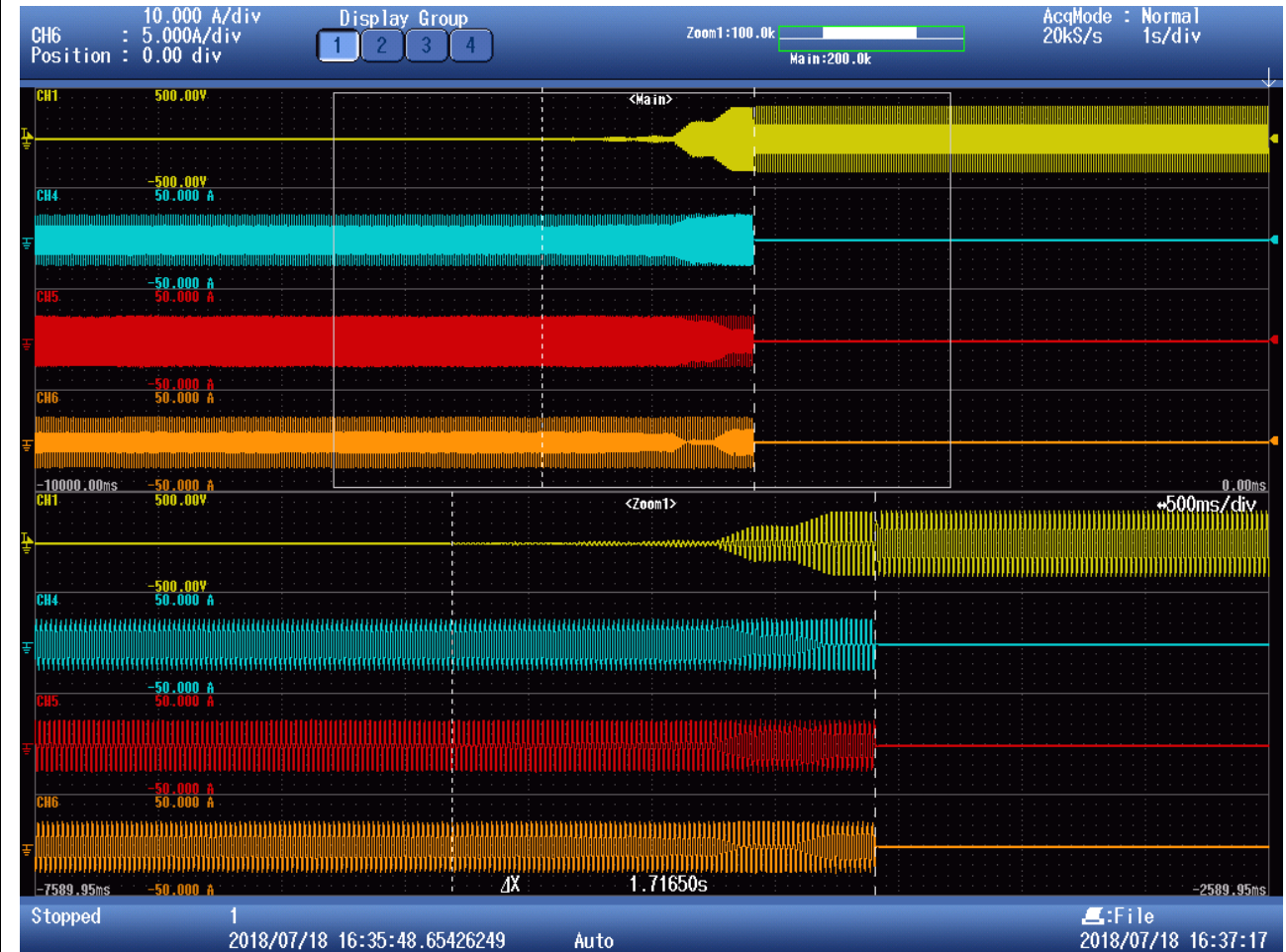
IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict

6.1 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)										P
Test conditions			Frequency: 50+/-0,1Hz U _N =230+/-3Vac Distortion factor of chokes < 2% Quality =1							
Disconnection limit			2s							
No	P _{EUT} ¹⁾ [% of EUT rating]	Reactive load [% of Q _L in 6.1.d) 1]	P _{AC} ²⁾ [% of nominal]	Q _{AC} ³⁾ [% of nominal]	I _{AC} ⁴⁾ [A]	P _{EUT} [W per phase]	V _{DC} [V]	Q _f [1]	Run on Time [ms]	Remarks ⁵⁾
22	33	33	0	-5	0.353	3700	360	0.980	361	IB
23	33	33	0	-4	0.342	3700	360	0.985	582	IB
24	33	33	0	-3	0.334	3700	360	0.990	1053	IB
25	33	33	0	-2	0.328	3700	360	0.995	959	IB
26	33	33	0	-1	0.324	3700	360	1.000	940	IB
3	33	33	0	0	0.323	3700	360	1.005	1717	BL
27	33	33	0	1	0.324	3700	360	1.010	924	IB
28	33	33	0	2	0.328	3700	360	1.015	154	IB
29	33	33	0	3	0.334	3700	360	1.020	114	IB
30	33	33	0	4	0.342	3700	360	1.025	119	IB
31	33	33	0	5	0.353	3700	360	1.030	108	IB
Parameter at 0%			L= 43.18 mH		R= 13.56 Ω		C= 237.08 μF			
Note: RLC is adjusted to min. +/-1% of the inverter rated output power 1) P _{EUT} : EUT output power 2) P _{AC} : Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value. 3) Q _{AC} : Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value. 4) Fundamental of I _{AC} when RLC is adjusted 5) BL: Balance condition, IB: Imbalance condition. Condition B: EUT output power P _{EUT} = 25 % – 33 % ⁶⁾ of maximum EUT input voltage ⁷⁾ = <20 % of rated input voltage range ⁶⁾ Or minimum allowable EUT output level if greater than 33 %. ⁷⁾ Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 10 % of range = X + 0,2 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.										

IEC 62116

IEC 62116			
Clause	Requirement + Test	Result - Remark	Verdict

Disconnection at P_{AC} 0% and Q_{AC} 0 reactive load and 33% nominal power



Annex No. 1

Pictures of the unit

The full pictures refer to PHOTO DOCUMENT

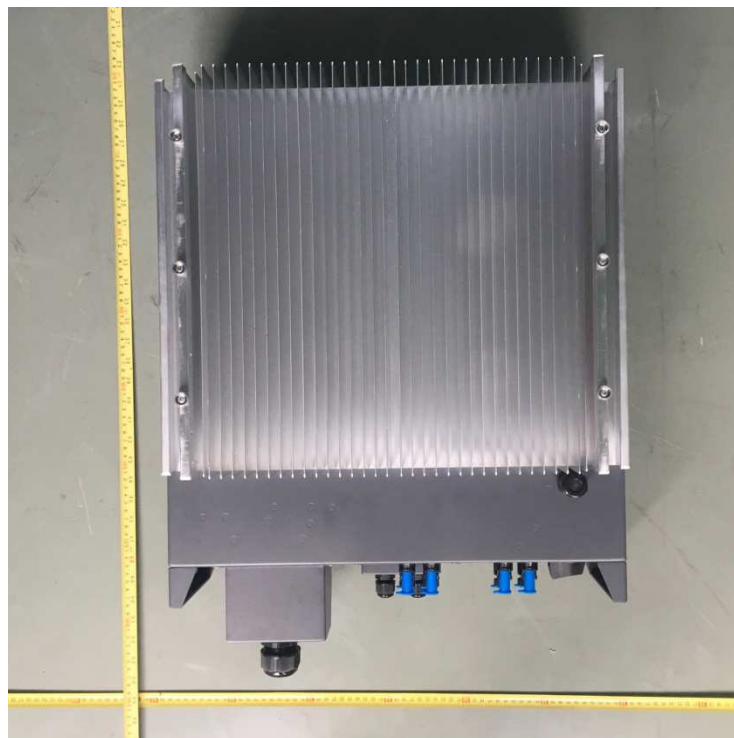
Project No.: 190308N051

Date: 20190705

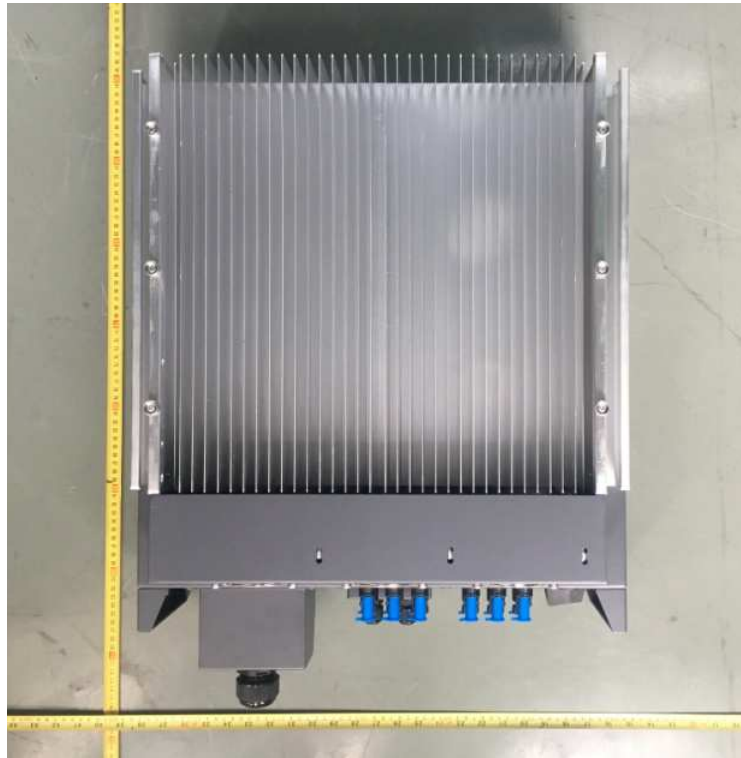
Enclosure front view:



Enclosure rear view: EVVO 20000TLG23P



Enclosure rear view: EVVO 25000TLG23P, EVVO 30000TLG23P, EVVO 33000TLG23P



Enclosure terminal view: EVVO 20000TLG23P



Enclosure terminal view: EVVO 25000TLG23P



Enclosure terminal view: EVVO 30000TLG23P, EVVO 33000TLG23P



Annex No. 2

Test Equipment list

Test location: Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch
Dates of performance test: 2018-07-12 to 2018-08-01

Equipment	Internal No.	Manufacturer	Type	Serial No.	Last Calibration
AC Source	A7040019DG	Chroma	61512	61512000439	Monitored by Power Analyzer
	A7040020DG	Chroma	61512	61512000438	
	A7040006DG	AC Power	ACST-S-33045T	C311120140	
DC Simulation Power Supply	A7040015DG	Chroma	62150H-1000S	62150EF00488	
	A7040016DG	Chroma	62150H-1000S	62150EF00490	
	A7040017DG	Chroma	620028	620028EF00120	
	A7040021DG	Chroma	62150H-1000S	62150EF00609	
RLC Load	A7150027DG	Qunling	ACLT-3803H	93VOO2869	
Resistive load cabinet	A7150030DG	Shenzhen Weihuaer	//	//	
	A7150029DG	Shenzhen Weihuaer	//	//	
Inductive load cabinet	A7180005DG	Shenzhen Weihuaer	//	//	
Power Analyzer	A4080002DG	YOKOGAWA	WT3000	91M210852	Jan. 12, 2018
Digital Phosphor Oscilloscope	A4089003DG	Tektronix	DPO4104B	C010624	Oct. 25, 2017
ScopeCorder	A4089017DG	YOKOGAWA	DL850-H-HC	91N726247	Sep. 01, 2017
Isolation voltage probe	A4089008DG	Tektronix	TPP1000	C008230	Dec. 06, 2017
	A4089009DG	Tektronix	TPP1000	C008231	Dec. 06, 2017
	A4089010DG	Tektronix	TPP1000	C008228	Dec. 06, 2017
	A4089011DG	Tektronix	TPP1000	C008229	Dec. 06, 2017
Current transducer	A1060007DG	YOKOGAWA	CT200	1130700012	Nov. 15, 2017
	A1060008DG	YOKOGAWA	CT200	1130700017	Nov. 15, 2017
	A1060009DG	YOKOGAWA	CT200	1130700019	Nov. 15, 2017
	A1060010DG	YOKOGAWA	CT200	1130700016	Nov. 15, 2017