

**TESTING FOR THE VERIFICATION OF COMPLIANCE OF
POWER CONVERTER WITH:**

**ARRÊTÉ DU 23 AVRIL 2008 RELATIF AUX
PRESCRIPTIONS TECHNIQUES DE CONCEPTION ET DE
FONCTIONNEMENT POUR LE RACCORDEMENT À UN
RÉSEAU PUBLIC DE DISTRIBUTION D'ÉLECTRICITÉ EN
BASSE TENSION OU EN MOYENNE TENSION D'UNE
INSTALLATION DE PRODUCTION D'ÉNERGIE
ÉLECTRIQUE**

Procedure: PE.T-LE-62

Test Report Number: 2220/0270-A

Trademark



Tested Model.....: HYD 15KTL-3PH

Variant Models: HYD 5KTL-3PH, HYD 6KTL-3PH; HYD 8KTL-3PH,
HYD 10KTL-3PH, HYD 20KTL-3PH;

APPLICANT

Name: Shenzhen SOFAR SOLAR Co., Ltd.

Address: 401, Building 4, AnTongDa Industrial Park, District 68,
XingDong Community, XinAn Street, BaoAn District, Shenzhen
City, Guangdong Province, P.R. China

TESTING LABORATORY

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Approved by: Jacobo Tévar
(Technical Reviewer)

Date of issue.....: 2020/ 08 / 26

Number of pages: 54

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Test Report Historical Revision:

Test Report Version	Date	Resume
2220/0270-A	2020 / 08 / 26	First issuance

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1 SCOPE

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch has been contracted by Shenzhen SOFAR SOLAR Co., Ltd, in order to perform the testing according to the «Arrêté du 23 avril 2008 relatif aux prescriptions techniques de conception et de fonctionnement pour le raccordement à un réseau public de distribution d'électricité en basse tension ou en moyenne tension d'une installation de production d'énergie électrique».

In addition, for the testing of the Chapter III of the regulation above mentioned, they have been taken into account deviations according to the both the Arrêté du 23 avril 2008 and the technical documentation reference SEI REF 02 (V5, 01/05/2014):

«Documentation technique de référence pour le raccordement des installations de production d'électricité aux réseaux des zones non interconnectées », for a testing frequency of 50 Hz.

Note: The EUT in this test report is used only for connection to photovoltaic power plants of Pmax <5 MW.

2 GENERAL INFORMATION

2.1 Testing period and Climatic conditions


The necessary testing has been performed along between the 03th of June and the 06th of August of 2020.

All the tests and checks have been performed at (25 ± 5) °C, (96 ± 10) kPa and (40 ± 10) %RH.

SITE TEST

Name : Shenzhen SOFAR SOLAR Co., Ltd.
 Address : 401, Building 4, AnTongDa Industrial Park, District 68,
 XingDong Community, XinAn Street, BaoAn District,
 Shenzhen City, Guangdong Province, P.R. China

2.2 Equipment Under Testing

Apparatus type : Hybrid Inverter (Three phase)
 Installation : Fixed (permanent connection)
 Manufacturer : Shenzhen SOFAR SOLAR Co., Ltd.
 Trademark : 
 Model / Type reference : HYD 15KTL-3PH
 Serial Number : SP1ES020H71002
 Software Version : V2.00
 Rated Characteristics : DC input: 180-960 V, Max. 2× 25 A
 AC output: 3~/N/PE 230 V, 50 Hz, 3× 21.7 A
 (max. 3× 24 A), 15000 W

Date of manufacturing: 2020

Test item particulars

Input..... : DC
 Output..... : AC
 Class of protection against electric shock... : Class I
 Degree of protection against moisture : IP65
 Type of connection to the main supply..... : TN
 Cooling group : See model list on page 8
 Modular : No
 Internal Transformer..... : No

Arrêté du 23 avril 2008

Copy of marking plate (representative):

SOFAR SOLAR Hybrid Inverter	
Model No:	HYD 15KTL-3PH
Max.DC Voltage	1000V
MPPT Voltage Range	180~960V
Max. Input Current	25/25A
Max.PV Isc	30/30A
Battery Type	Li-Ion
Battery Voltage Range	180~800V
Battery Max. Charging Current	25/25A
Battery Max. Discharging Current	25/25A
Nominal Grid/Back-up Voltage	3/N/PE, 380/400V
Nominal Grid/Back-up Frequency	50/60Hz
Max. Current Output to Grid	24A
Max. Power Output to Grid	16500VA
Max. Current from Grid	44A
Max. Power from Grid	30000VA
Back-up Max. Output Current	24A
Back-up Max. Output Power	16500VA
Power Factor	1 (adjustable +/- 0.8)
Operating Temperature Range	-30~+60°C
Ingress Protection	IP65
Protective Class	Class I
Inverter Topology	Non-isolated
Overvoltage Category	AC III, DC II
Manufacturer : Shenzhen SOFAR SOLAR Co.,Ltd. Address : 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community,XinAn Street, BaoAn District, Shenzhen, China	
SAA VDE0126-1-1,VDE-AR-N4105 G98, G99, EN50438, AS4777, UTE C15-712-1	

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.
3. Labels of other models are as the same of **HYD 15KTL-3PH**'s except the parameters of rating.

Equipment under testing:

- HYD 15KTL-3PH

The variants models are:

- HYD 5KTL-3PH
- HYD 6KTL-3PH
- HYD 8KTL-3PH
- HYD 10KTL-3PH
- HYD 20KTL-3PH

Model	HYD 5KTL-3PH	HYD 6KTL-3PH	HYD 8KTL-3PH	HYD 10KTL-3PH	HYD 15KTL-3PH	HYD 20KTL-3PH
PV String Input Data						
Max. DC voltage	1000 V					
MPPT voltage range	180~960 V					
Full power MPPT voltage range	250~850 V	320~850 V	360~850 V	220~850 V	350~850 V	450~850 V
Max. input current	12.5/12.5 A	12.5/12.5 A	12.5/12.5 A	25/25 A	25/25 A	25/25 A
Max. short current	15/15 A	15/15 A	15/15 A	30/30 A	30/30 A	30/30 A
Battery Input Data						
Battery voltage range	180~800 V					
Battery voltage range for full load	200~800 V	240~800 V	320~800 V	200~800 V	300~800 V	400~800 V
No. of battery input	1			2		
Nominal charging/discharging power	5000 W	6000 W	8000 W	10000 W	15000 W	20000 W
Max. charging/discharging current	25 A	25 A	25 A	50 A (25/25 A)	50 A (25/25 A)	50 A (25/25 A)
AC Output Data (On-grid)						
Nominal AC power	5000 W	6000 W	8000 W	10000 W	15000 W	20000 W
Max. AC power output to utility grid	5500 VA	6600 VA	8800 VA	11000 VA	16500 VA	22000 VA
Max. AC power from utility grid	10000 VA	12000 VA	16000 VA	20000 VA	30000 VA	40000 VA
Max. AC current output to utility grid	8 A	10 A	13 A	16 A	24 A	32 A
Rated AC current output to utility grid	7.2 A	8.7 A	11.6 A	14.5 A	21.7 A	29 A
Max. AC Current from utility grid	15 A	17 A	24 A	29 A	44 A	58 A
Nominal output voltage	3/N/PE, 380/400 Vac					
Nominal output frequency	50 Hz					
Output power factor	~1 (0.8 leading to 0.8 lagging)					
AC Output Data (Back-up)						
Nominal output power	5000 W	6000 W	8000 W	10000 W	15000 W	20000 W
Max. output power	5500 VA	6600 VA	8800 VA	11000 VA	16500 VA	22000 VA
Rated. output current	7.2 A	8.7 A	11.6 A	14.5 A	21.7 A	29 A
Max. output current	8 A	10 A	13 A	16 A	24 A	32 A

Nominal output voltage	3/N/PE, 380/400 Vac					
Nominal output frequency	50 Hz					
Output power factor	~1 (0.8 leading to 0.8 lagging)					
Operating temperature range	-30 °C ~ 60 °C					
Ingress protection	IP65					
Protective class	Class I					
Cooling method	Heat sink	Heat sink	Heat sink	Fan	Fan	Fan

The variants models have been included in this test report without tests because the following features don't change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Output power within $1/\sqrt{10}$ and 2 times of the rated output power or the EUT or Modular inverters.
- Same Firmware Version

The results obtained apply only to the particular sample tested that is the subject of the present test report. The most unfavorable result values of the verifications and tests performed are contained herein. Throughout this report a point (comma) is used as the decimal separator.

2.3 Manufacturer and Factory information

Manufacturer Name..... : **Shenzhen SOFAR SOLAR Co., Ltd.**

Manufacturer Address..... : 401, Building 4, AnTongDa Industrial Park,
District 68, XingDong Community, XinAn Street,
BaoAn District, Shenzhen City, Guangdong
Province, P.R. China

Factory 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, Guangdong Province, P.R.
China.

2.4 TEST EQUIPMENT LIST

From	No.	Equipment Name	Model No.	Equipment No.	Calibration Date	Equipment calibration due date
Sofar Solar	1	Digital oscilloscope	KEYSIGHT / DS0X3014A	MY58101647	2020/01/14	2021/01/13
	2	Voltage probe	SanHua / SI-9110	111152	2020/1/14	2021/1/13
	3	Voltage probe	SanHua / SI-9110	152627	2020/01/14	2021/01/13
	4	Voltage probe	SanHua / SI-9110	111134	2020/01/14	2021/01/13
	5	Power analyzer	ZLG / PA3000	PA3004-P0004-1422	2020/01/14	2021/01/13
	6	Current probe	CYBERTEK / CP1000A	C181000922	2020/01/14	2021/01/13
	7	Current probe	CYBERTEK / CP1000A	C181000925	2020/01/14	2021/01/13
	8	Current probe	CYBERTEK / CP1000A	C181000929	2020/01/14	2021/01/13
	9	Temperature & Humidity meter	Anymeters / TH101B	ZB-WSDJ-001	2020/01/14	2021/01/13
	10	Digital oscilloscope	Tektronix / MD03024	C055210	2020/04/24	2021/04/23
SGS	11	True RMS Multimeter	Fluke / 187	80780025 (GZE012-8)	2019/12/05	2020/12/04

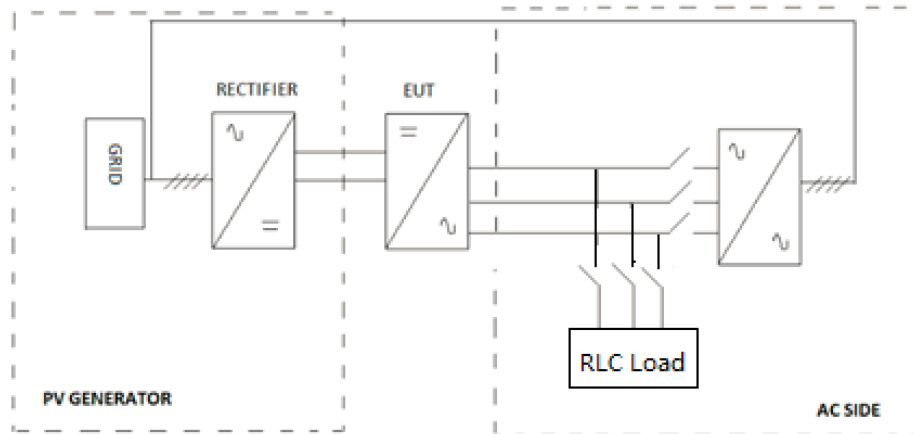
2.5 Measurement Uncertainty

Associated uncertainties through measurements showed in this this report are the maximum allowable uncertainties.

Magnitude	Uncertainty
Voltage measurement	±1.5 %
Current measurement	±2.0 %
Frequency measurement	±0.2 %
Time measurement	±0.2 %
Power measurement	±2.5 %
Phase Angle	±1 °
Temperature	±3 °C
<p>Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties. The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the petitioner.</p> <p>Note2: Where the standard requires lower uncertainties that those in this table. Most restrictive uncertainty has been considered.</p>	

2.6 Test set up of the different standard

Below is the simplified construction of the test set up.



Different equipments have been used to take measures as shown in chapter 2.3. Current and voltage clamps have been connected to the inverter input / output for all the tests.

All the tests described in the following pages have used this specified test setup.

The test bench used includes:

EQUIPMENT	MARK / MODEL	RATED CHARACTERISTICS	OWNER / ID. CODE
AC source	Kwell / AFG-S-33800	Voltage: 0-600 V, 750 kVA	Sofar Solar / EP-026
PV source	Kwell / TVS-630kW	Voltage: 0-1000 V, 630 kW	Sofar Solar / EP-027
RLC load	Qunlin / ACLT3820H	68 kW, 68 kVAr	Sofar Solar / EP-029

2.7 Definitions

EUT	Equipment Under Testing	Hz	Hertz
A	Ampere	V	Volt
VA _r	Volt-Ampere reactive	W	Watt
EMC	Electromagnetic Compatibility	p.u	Per unit
U _n	Nominal Voltage	P _n	Nominal Active Power
I _n	Nominal Current	Q _n	Nominal Reactive Power
I _a	Active Current	S _n	Nominal Apparent Power
I _r	Reactive Current	THD	Total Harmonic Distortion
MV	Medium Voltage	TDD	Total Demand Distortion
LV	Low Voltage	U _i	Current Imbalance
LVRT	Low Voltage Ride Through	U _v	Voltage Imbalance
V ₁₊	Voltage positive sequence	I ₁₊	Current Positive Sequence
V ₁₋	Voltage negative sequence	I ₁₋	Current Negative Sequence
NL	Nonlinearity	I _{sc}	Short Circuit Current
PST	Severity of Flicker Short-Term	PLT	Severity of Flicker Long-Term
d _c	Maximum Variation of Voltage	d(t)	Variation of Voltage
d _{max}	Maximum Absolute Value of Voltage Variation	ZNI	Zone Non Interconnected

3 RESUME OF TEST RESULTS

INTERPRETATION KEYS

Test object does meet the requirement **P** Pass
 Test object does not meet the requirement **F** Fails
 Test case does not apply to the test object **N/A** Not applicable
 To make a reference to a table or an annex. See additional sheet
 To indicate that the test has not been realized **N/R** Not realized

STANDARD SECTION	STANDARD REQUIREMENTS	
	ARRÊTÉ DU 23 AVRIL 2008	
Chapitre I^{er}	Etude et tension de raccordement	--
	Electromagnetic compatibility	P
Chapitre II	Prescriptions techniques applicables dans le cas général	--
Section 1	Sécurité des personnes et des biens	--
Article 6	Short circuit contribution	P
Article 7	Disconnection device	P
Section 2	Domaine de fonctionnement de l'installation	--
Article 9	Reactive power depending voltage variations (connect to LV)	P
Article 10	Reactive power depending voltage variations (connect to HV)	N/A
Article 11	Frequency ranges	--
	I. Frequency operation field	N/A
	II. Active power response due to over frequency variations	N/A
Article 12	Voltage ranges	P
Article 13	Voltage and frequency simultaneous variations	P
Article 14	Fault ride through	N/A
Section 3	Prescriptions diverses	--
Article 15	II. Power quality for HV connection cases	--
	Current harmonics (HV)	N/A
	Unbalance (HV)	N/A
	Flickers (LV)	P
Article 16	Power gradient constraint	P
Chapitre III	Prescriptions techniques particulières applicables aux installations de production situées dans une zone du territoire non interconnectée au réseau métropolitain continental	--
Article 18-1	Fault ride through (ZNI)	N/A
Article 19	Frequency ranges (ZNI)	--
	I. Normal operation range	P
	II. Frequency operation field	P
Article 20	Voltage and frequency simultaneous variations (ZNI)	P

4 TEST RESULTS

4.1 CONNECTION ANALYSIS: EMC COMPLIANCE

As required in Article 3 of the 1st Chapter, all electric and electronic equipment to be installed under the scope of this standard shall be in compliance with relative standards for Electromagnetic Compatibility.

The compliances with these requirements are stated in the following test report:

- EMC Test Report: Test Report no. CE200608N033 dated on 2020/06/17 which has been issued by Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch.

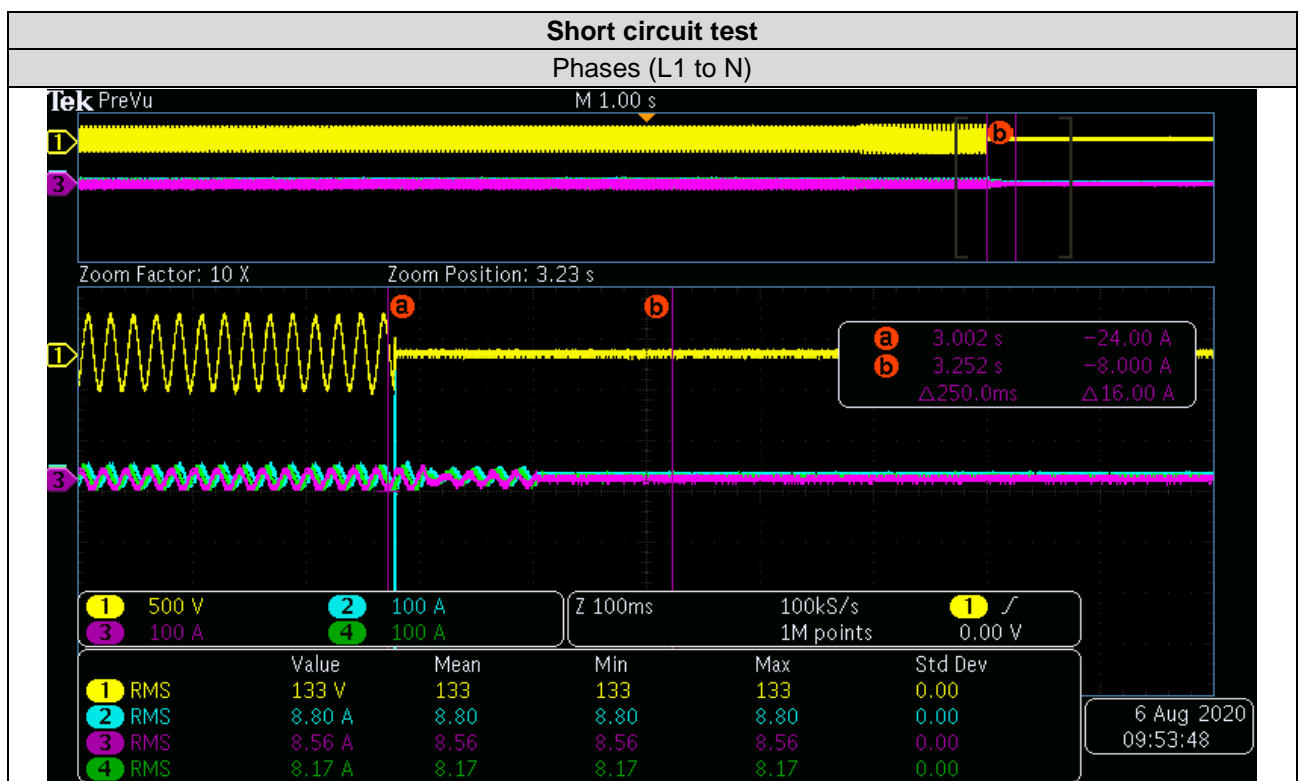
4.2 TECHNICAL REQUIREMENTS FOR GENERAL CONNECTION CASES

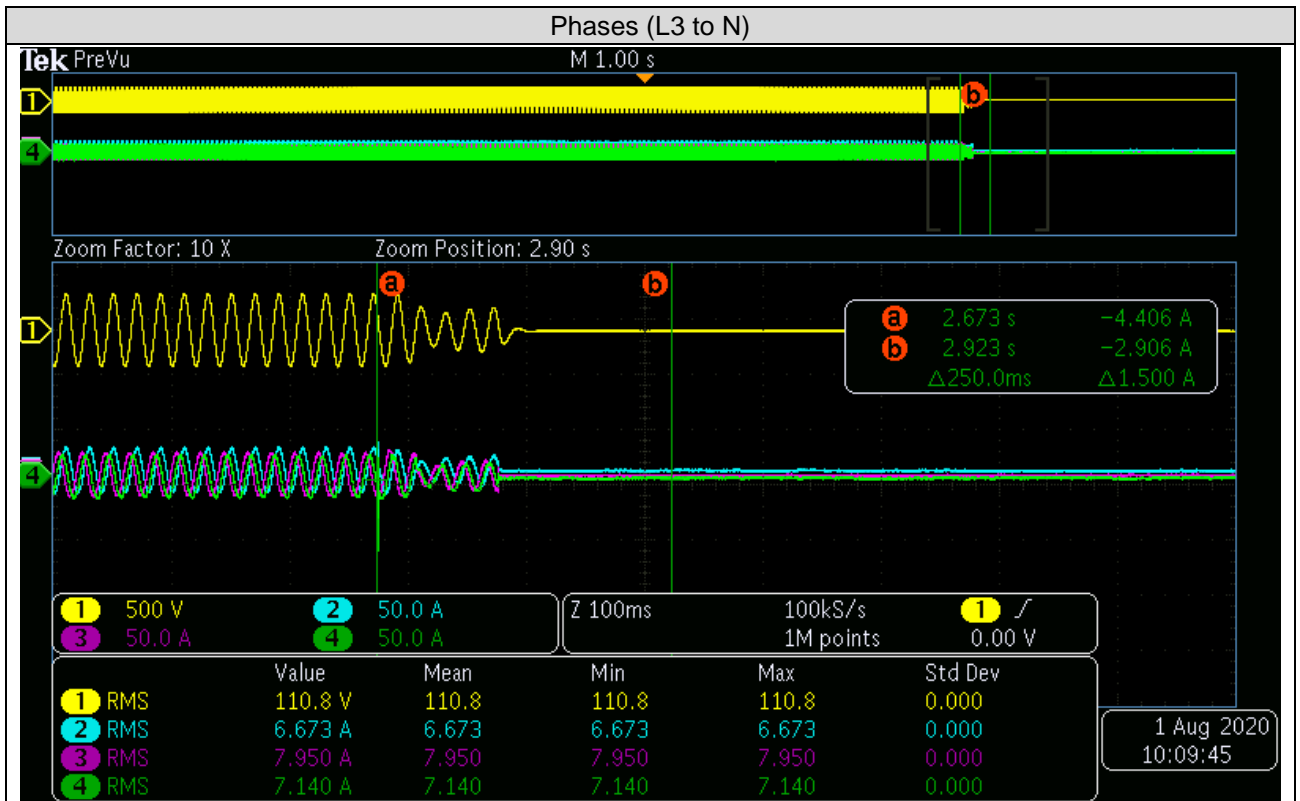
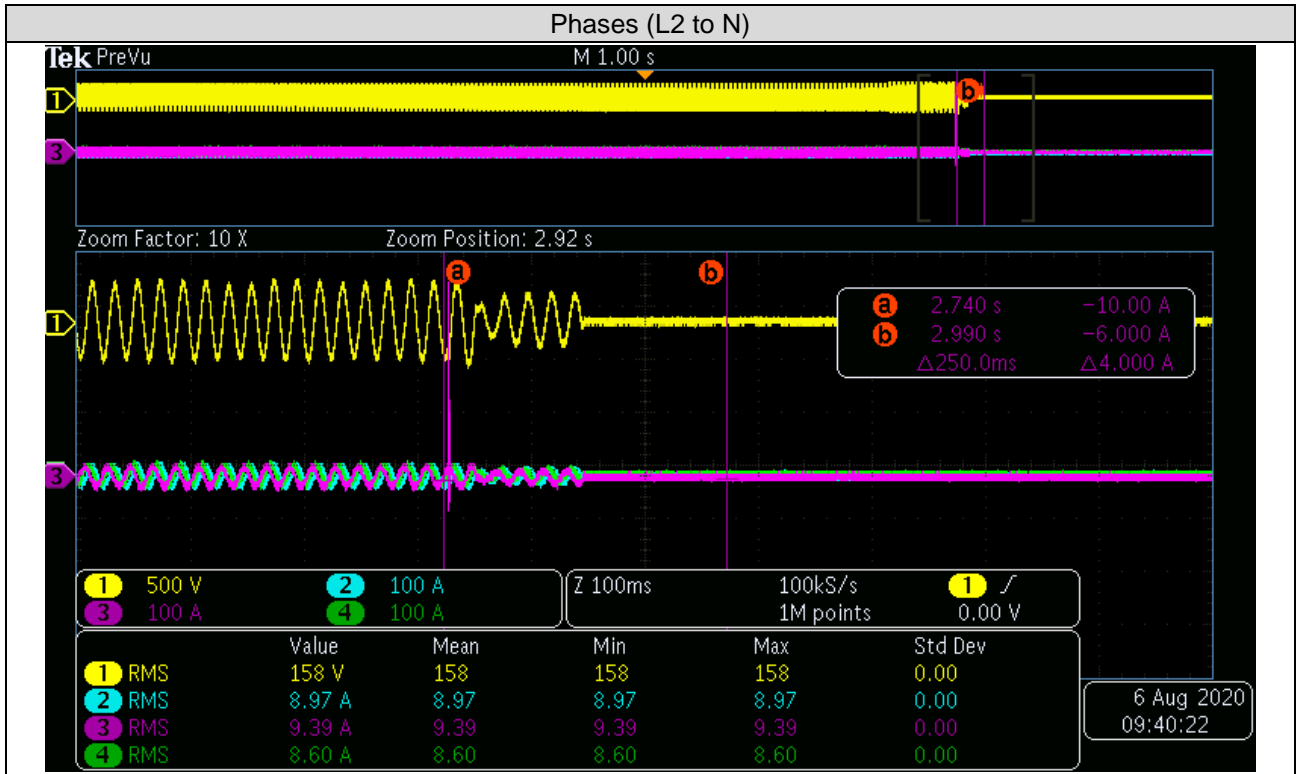
4.2.1 Short Circuit Contribution

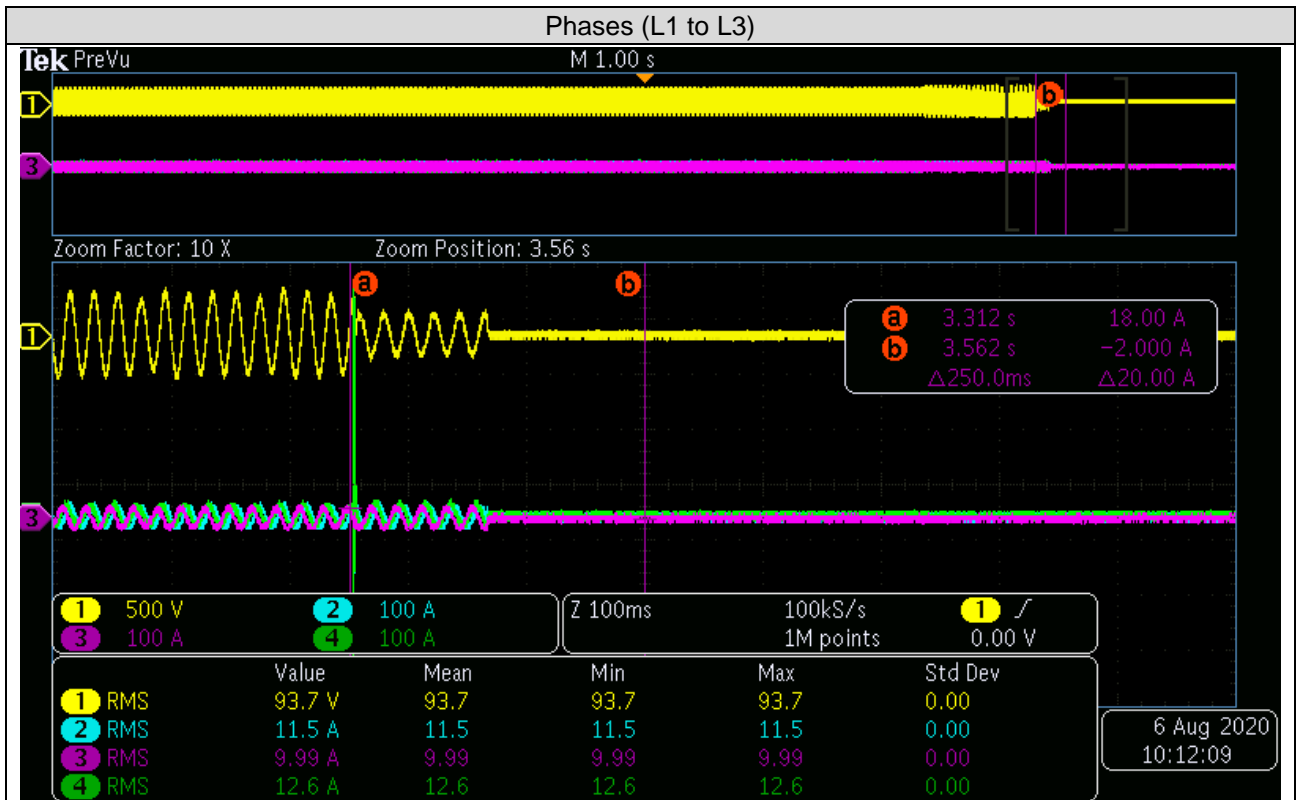
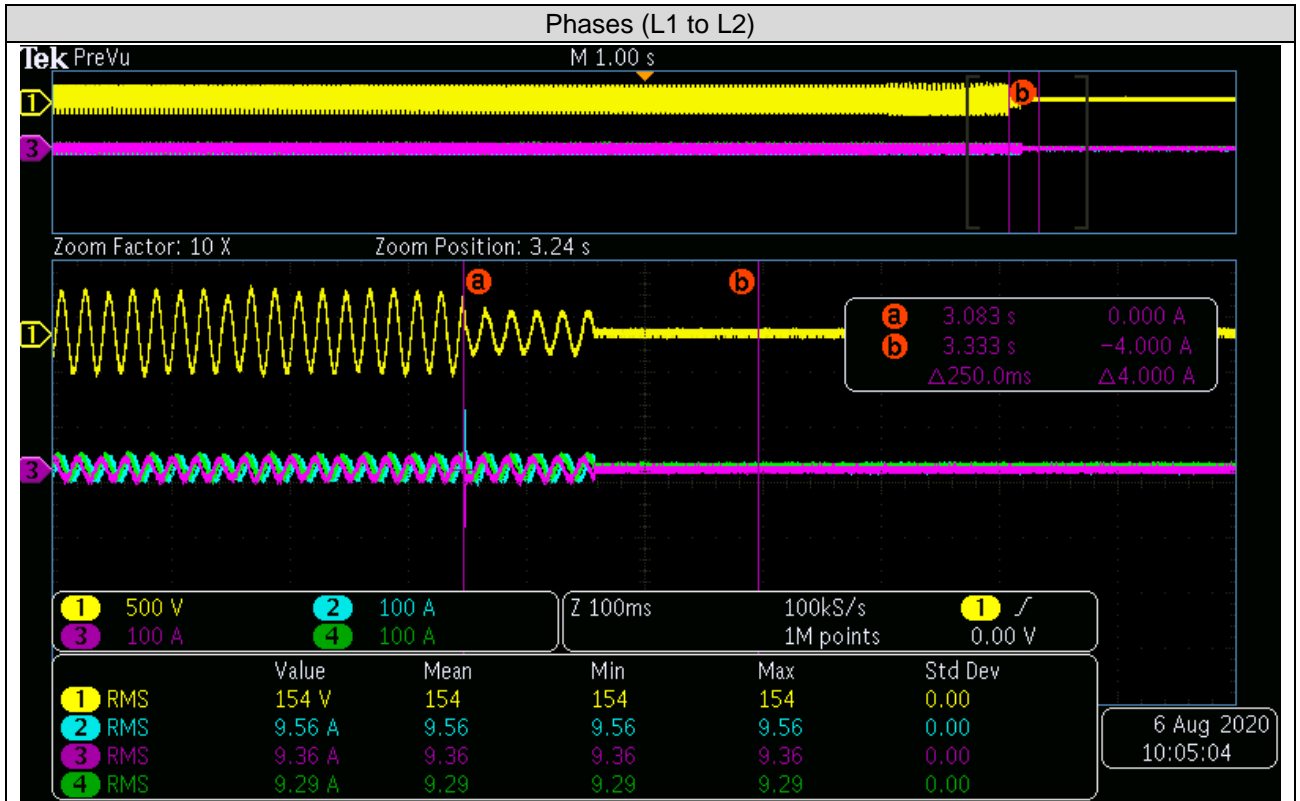
As specified in the Article 6, the contribution of the Short Circuit Current has been verified.

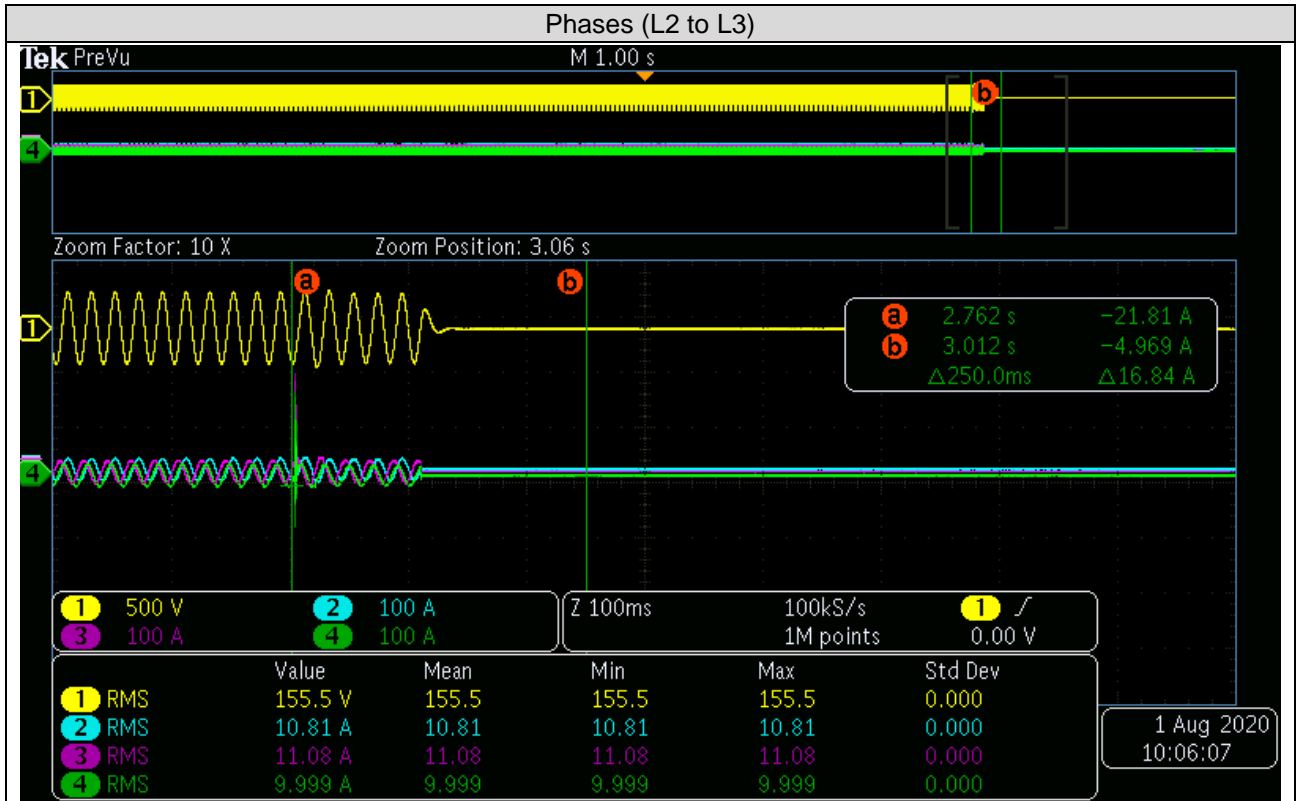
They have been performed short circuit tests that are detailed in the table and pictures below.

Short circuit current	
Short Circuit Applied	Isc Max (A)
Phases (L1 to N)	8.8
Phases (L2 to N)	9.4
Phases (L3 to N)	8.0
Phases (L1 to L2)	9.6
Phases (L1 to L3)	12.6
Phases (L2 to L3)	11.1









4.2.2 Disconnection Device

As required in the Article 7, the inverter must have corresponding disconnecting devices able to detect abnormal situations of voltage and frequency.

This protection device shall disconnect the equipment from the grid in case that these abnormal situations are detected.

For the equipment under testing, it has been verified that protection relays are adjustable in voltage and frequency disconnecting values, as well as for disconnecting trip times.

As declared by the manufacturer, the protection device has different stages that can be configurable according to the following ranges:

Parameter	Threshold	Response time (s)
Undervoltage Stage 2 U<<	35 % to 195 %Un	0.01 to 200.00
Undervoltage Stage 1 U<	35 % to 195 %Un	0.01 to 200.00
Overvoltage Stage 1 U>	35 % to 195 %Un	0.01 to 200.00
Overvoltage Stage 2 U>>	35 % to 195 %Un	0.01 to 200.00
Overfrequency Stage 2 f>>	40 to 70 Hz	0.01 to 100.00
Overfrequency Stage 1 f>>	40 to 70 Hz	0.01 to 100.00
Underfrequency Stage 1 f<	40 to 70 Hz	0.01 to 100.00
Underfrequency Stage 2 f<<	40 to 70 Hz	0.01 to 100.00

In addition to this, the declared maximum response time delay declared by the manufacturer is 100 ms.

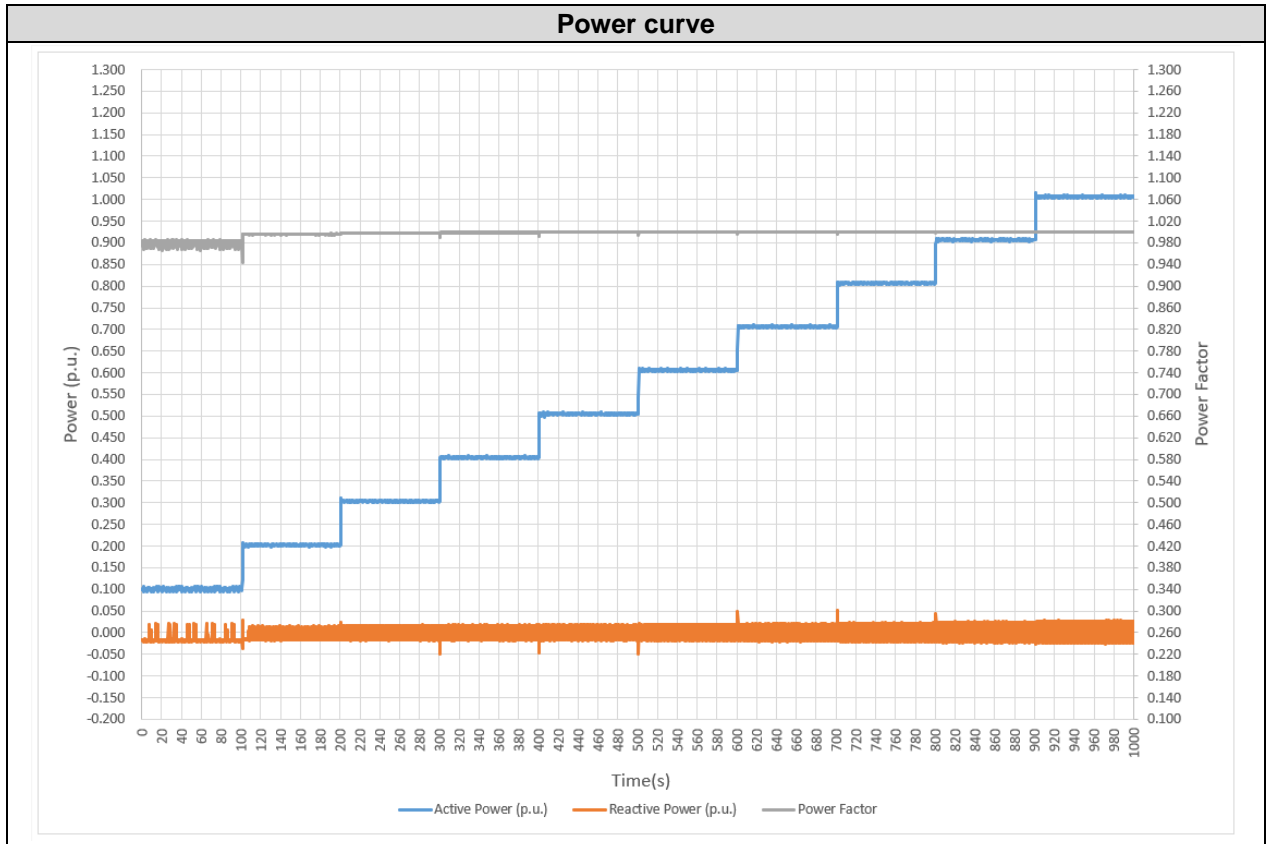
This protection device is able to disconnect the equipment from the grid in case that these abnormal situations are detected. The following test report clause 4.9.3 shows compliance with these requirements:

- EN 50549-1 2019: Test Report n° PV200302N015-6 dated on 2020/08/21 which has been issued by Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch.

4.2.3 Reactive Power depending voltage variations

According to Article 9 of the standard, the equipment installed in LV grid. It shall not absorb reactive power from the grid.

To show compliance with this capability, the following test has been done. It shows the reactive power from 10 %Pn to 100 %Pn almost are 5 %Sn.



4.2.4 Voltage and Frequency Operation Ranges

Voltage and Frequency normal operation ranges have been verified simultaneously according to the prescriptions stated in the Article 13 of the Chapter II of the standard, Section 2.

They have been taking into account minimum ranges and operation times stated in the Article 12 (voltage) of the standard because of the equipment is not able to connect to PV plant of $P_{max} > 5$ MW. The inverter must stay connected providing the maximum of its available active power, working in abnormal voltage conditions.

The following tables show the results of the tests performed:

Test 1		Undervoltage			
Voltage	Frequency	Active Power desired (p.u.)	Active Power measured (*)	Minimum Operation Time	Time measured
90 %Un	50 Hz	> 95.0 %Pn	100.0 %Pn	20 min.	29 min.
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

Test 2		Overvoltage			
Voltage	Frequency	Active Power desired (p.u.)	Active Power measured (*)	Minimum Operation Time	Time measured
110 %Un	50 Hz	> 95.0 %Pn	100.2 %Pn	20 min.	22 min.
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

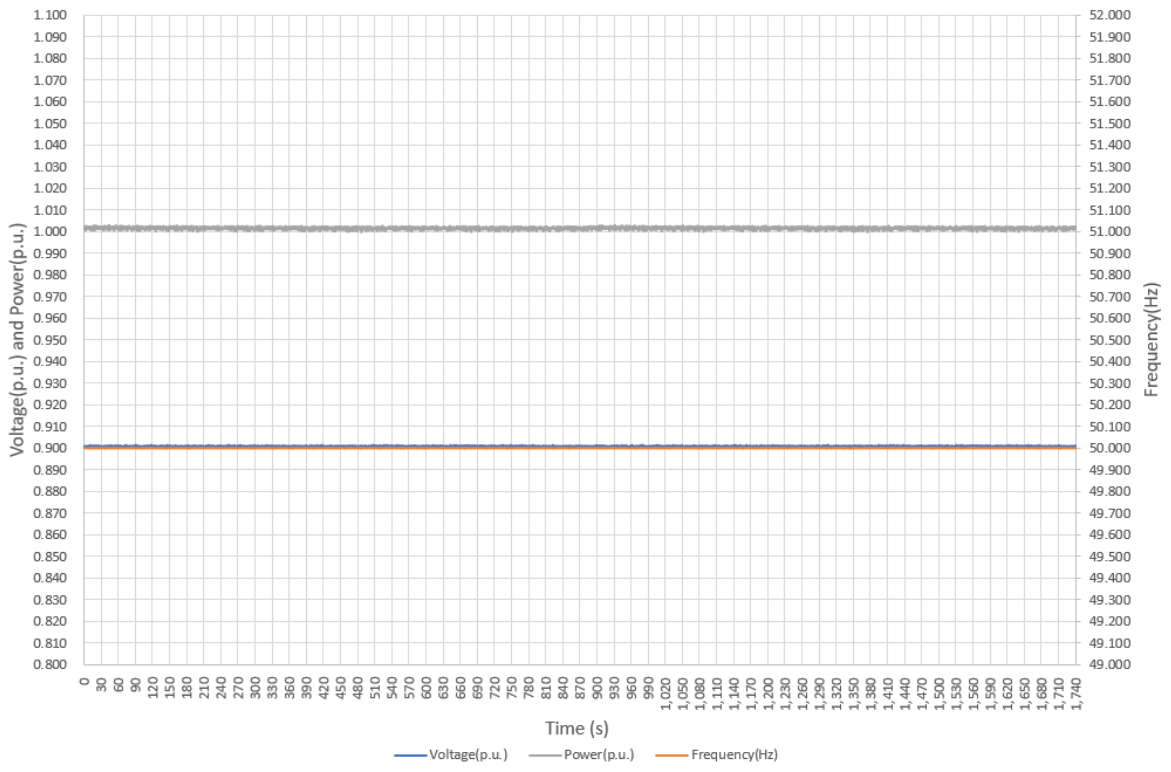
All tests results above offered have been obtained with the automatic control system for the regulation of active power in front of frequency variations disabled.

As there haven't been measured considerable power losses at the above stated voltage and frequency levels, and they have been considered the most restrictive minimum operation times, it is ensured that the inverter shall have the same behaviour inside these operation ranges.

(*) This value of active power is calculated as the average of the samples taken each 1 s during the corresponding measured time.

Test results are graphically shown below and in following pages.

Test 1 (U = 90 %Un and f = 50 Hz)

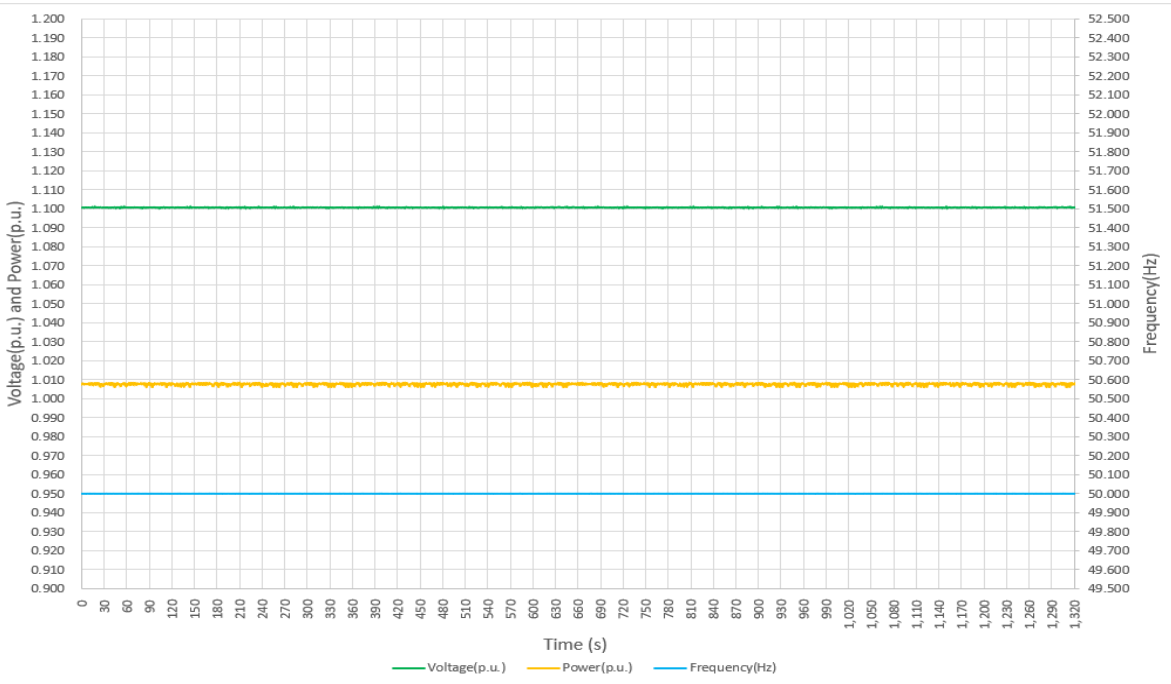


Time measured: 29 min

Voltage average measured: 90.1 %Un

Frequency measured: 50.00 Hz

Test 2 (U = 110 %Un and f =50 Hz)



Time measured: 22 min

Voltage average measured: 110.1 %Un

Frequency measured: 50.00 Hz

4.2.5 Active Power Response due to Over Frequency Variations

The test to verify the automatic response for active power reduction due to over frequency variations has to be performed according to the Article 11, point ii.

It is not applicable due to the inverter is not possible to connect to PV plant $P_{max} > 5$ MW.

4.2.6 Fault Ride Through

Fault Ride Through tests has to be performed according to the Article 14 of the standard.

It is not applicable due to the inverter is not possible to connect to PV plant of $P_{max} > 5$ MW.

4.2.7 Power Quality

4.2.7.1 Current harmonics

The maximum harmonic emission level is specified in Article 15, point ii of the standard.

It is not applicable to the EUT due to output P_{max} is not greater than or equal to 100 kW.

4.2.7.2 Unbalance

The voltage unbalance test has to be performed according to the Article 15, point ii, of the standard.

It is not applicable due to the inverter is to be connected to a Low voltage grid.

4.2.7.3 Flickers

Measurements of voltage fluctuations in continuous operation have been performed according to the Article 15, point i, of the standard.

The contribution level of the production plant to long-time flicker (Plt) must be limited to the delivery point of 1.

The measurements of voltage fluctuations have been measured according to the standard, at 33 %, 66 % and 100 % of the nominal power value of the inverter. Test performed following the 61000-3-11.

Starting operation and Stopping operation 33 %Pn				
Pbin (%)	Limit	Phase A	Phase B	Phase C
PST	≤ 1.0	0.06	0.14	0.04
PLT	≤ 0.65	0.05	0.14	0.04
dc	≤ 3.30 %	0.13 %	0.04 %	0.00 %
dmax	4.00%	0.18 %	0.12 %	0.00 %

Starting operation and Stopping operation 66 %Pn				
Pbin (%)	Limit	Phase A	Phase B	Phase C
PST	≤ 1.0	0.06	0.14	0.04
PLT	≤ 0.65	0.06	0.14	0.04
dc	≤ 3.30 %	0.11 %	0.03 %	0.02 %
dmax	4.00 %	0.35 %	0.11 %	0.11 %

Starting operation and Stopping operation 100 %Pn				
Pbin (%)	Limit	Phase A	Phase B	Phase C
PST	≤ 1.0	0.06	0.14	0.05
PLT	≤ 0.65	0.06	0.14	0.05
dc	≤ 3.30 %	0.11 %	0.01 %	0.00 %
dmax	4.00 %	0.17 %	0.12 %	0.11 %

As it can be seen in the next screenshots, this test has two steps, each step is 10 minutes:

- 1.Starting operation
- 2.Stopping operation

The values took of Pst and Plt are the most unfavorable of the two steps.

33 %Pn Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL

AVG

Line Filter

Freq Filter

PA_00017.tif

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 300 V/50Hz Element1 Judgement Pass

Un (U1) 230.252V Total Judgement Pass

Freq (U1) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.129 Pass	0.176 Pass	0.0 Pass	0.055 Pass	
2	0.102 Pass	0.154 Pass	0.0 Pass	0.054 Pass	
Result	Pass	Pass	Pass	Pass	0.054 Pass

Update: 634 Runtime: 5:32:04 100% 0% x1 2020-06-06 14:13:51

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL

AVG

Line Filter

Freq Filter

PA_00017.tif

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 300 V/50Hz Element2 Judgement Pass

Un (U2) 230.276V Total Judgement Pass

Freq (U2) 50.107Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.031 Pass	0.113 Pass	0.0 Pass	0.136 Pass	
2	0.036 Pass	0.115 Pass	0.0 Pass	0.136 Pass	
Result	Pass	Pass	Pass	Pass	0.136 Pass

Update: 639 Runtime: 5:32:13 100% 0% x1 2020-06-06 14:14:00

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Arrêté du 23 avril 2008

Phase C

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter

AVG Freq Filter

PA_00018.tif

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 300 V/50Hz

Un (U3) 230.364V

Freq (U3) 50.000Hz

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
2	0.000 Pass	0.000 Pass	0.0 Pass	0.043 Pass	
Result	Pass	Pass	Pass	Pass	0.042 Pass

ΣA(3P4W)

U1 300 V

I1 50 A

Sync Src: U1

Integral: Reset

U2 300 V

I2 50 A

Sync Src: U1

Integral: Reset

U3 300 V

I3 50 A

Sync Src: U1

Integral: Reset

Element 4

U4 1000 V

I4 50 A

Sync Src: U1

Integral: Reset

Element 5

U5 1000 V

I5 5 A

Sync Src: U1

Integral: Reset

Update: 642
Runtime: 5:32:19

138% 10%

2020-06-06 14:14:06

66 %Pn

Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter

AVG Freq Filter

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 300 V/50Hz

Un (U1) 230.468V

Freq (U1) 50.000Hz

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.094 Pass	0.284 Pass	0.0 Pass	0.058 Pass	
2	0.108 Pass	0.353 Pass	0.0 Pass	0.059 Pass	
Result	Pass	Pass	Pass	Pass	0.059 Pass

ΣA(3P4W)

U1 300 V

I1 50 A

Sync Src: U1

Integral: Reset

U2 300 V

I2 50 A

Sync Src: U1

Integral: Reset

U3 300 V

I3 50 A

Sync Src: U1

Integral: Reset

Element 4

U4 1000 V

I4 50 A

Sync Src: U1

Integral: Reset

Element 5

U5 1000 V

I5 5 A

Sync Src: U1

Integral: Reset

Update: 633
Runtime: 5:08:58

138% 10%

2020-06-06 13:50:45

Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter

AVG Freq Filter

PA_00013.tif

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 300 V/50Hz

Un (U2) 230.528V

Freq (U2) 50.000Hz

Dmin 0.10%

Element2

Total

(Element1,2,3)

Judgement Pass

Judgement Pass

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.034 Pass	0.113 Pass	0.0 Pass	0.135 Pass	
2	0.001 Pass	0.101 Pass	0.0 Pass	0.135 Pass	
Result	Pass	Pass	Pass	Pass	0.135 Pass

Update: 637

Runtime: 5:09:06

138%
10%
2020-06-06
13:50:53

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase C

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter

AVG Freq Filter

PA_00014.tif

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 300 V/50Hz

Un (U3) 230.635V

Freq (U3) 50.000Hz

Dmin 0.10%

Element3

Total

(Element1,2,3)

Judgement Pass

Judgement Pass

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.019 Pass	0.100 Pass	0.0 Pass	0.042 Pass	
2	0.008 Pass	0.112 Pass	0.0 Pass	0.043 Pass	
Result	Pass	Pass	Pass	Pass	0.043 Pass

Update: 640

Runtime: 5:09:13

138%
10%
2020-06-06
13:51:00

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

100 %Pn Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL

AVG

Line Filter

Freq Filter

CH: 1 2 3

4 5 6 7

Count 2/2 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 300 V/50Hz

Un (U1) 230.901V

Freq (U1) 50.000Hz

Dmin 0.10%

Element1

Total

(Element1,2,3)

Judgement Pass

Judgement Pass

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.105 Pass	0.155 Pass	0.0 Pass	0.061 Pass	
2	0.101 Pass	0.173 Pass	0.0 Pass	0.054 Pass	
Result	Pass	Pass	Pass	Pass	0.058 Pass

ΣA(3P4W)

U1 300 V

I1 50 A

Sync Src: U1

Integral: Reset

U2 300 V

I2 50 A

Sync Src: U1

Integral: Reset

U3 300 V

I3 50 A

Sync Src: U1

Integral: Reset

Element 4

U4 1000 V

I4 50 A

Sync Src: U1

Integral: Reset

Element 5

U5 1000 V

I5 5 A

Sync Src: U1

Integral: Reset

Update: 727

Runtime: 2:33:03

138%

0%

x1

2020-06-06

11:14:49

Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL

AVG

Line Filter

Freq Filter

PA_00010.tif

Count 2/2 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 300 V/50Hz

Un (U2) 230.892V

Freq (U2) 50.000Hz

Dmin 0.10%

Element2

Total

(Element1,2,3)

Judgement Pass

Judgement Pass

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.010 Pass	0.108 Pass	0.0 Pass	0.139 Pass	
2	0.012 Pass	0.122 Pass	0.0 Pass	0.139 Pass	
Result	Pass	Pass	Pass	Pass	0.139 Pass

ΣA(3P4W)

U1 300 V

I1 50 A

Sync Src: U1

Integral: Reset

U2 300 V

I2 50 A

Sync Src: U1

Integral: Reset

U3 300 V

I3 50 A

Sync Src: U1

Integral: Reset

Element 4

U4 1000 V

I4 50 A

Sync Src: U1

Integral: Reset

Element 5

U5 1000 V

I5 5 A

Sync Src: U1

Integral: Reset

Update: 732

Runtime: 2:33:12

138%

0%

x1

2020-06-06

11:14:59

Phase C

Flicker Mode
Flicker

Range Over
U1 U2 U3 U4 U5 U6 U7
I1 I2 I3 I4 I5 I6 I7

SCL
 AVG

Line Filter
 Freq Filter

PA_00011.tif

CH: 1 2 3
4 5 6 7

Count 2/2
 Interval 00:00s/10:00s

Complete

Element 3
 Volt Range 300 V/50Hz
 Un (U3) 231.048V
 Freq (U3) 50.000Hz
 Dmin 0.10%

Element3 Judgement Pass
 Total Judgement Pass
 (Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:2
No. 1	0.000 Pass	0.000 Pass	0.0 Pass	0.049 Pass	
2	0.004 Pass	0.105 Pass	0.0 Pass	0.049 Pass	
Result	Pass	Pass	Pass	Pass	0.049 Pass

Update: 735

Runtime: 233:19

138%
10%
2020-06-06
11:15:06

Each step of this test running for 10 minutes, total of 12 steps:

Running operation 33 %Pn				
Pbin (%)	Limit	Phase A	Phase B	Phase C
PST	≤ 1.0	0.06	0.14	0.05
PLT	≤ 0.65	0.05	0.14	0.05
dc	≤ 3.30 %	0.12 %	0.02 %	0.06 %
dmax	4.00 %	0.19 %	0.16 %	0.11 %

Running operation 66 %Pn				
Pbin (%)	Limit	Phase A	Phase B	Phase C
PST	≤ 1.0	0.04	0.14	0.05
PLT	≤ 0.65	0.03	0.14	0.05
dc	≤ 3.30%	0.11%	0.01%	0.02%
dmax	4.00 %	0.21%	0.12%	0.11%

Running operation 100 %Pn				
Pbin (%)	Limit	Phase A	Phase B	Phase C
PST	≤ 1.0	0.06	0.14	0.04
PLT	≤ 0.65	0.05	0.14	0.04
dc	≤ 3.30 %	0.13 %	0.05 %	0.00 %
dmax	4.00 %	0.18 %	0.15 %	0.00 %

As it can be seen in the next screenshots is running operation. The values took of Pst and Plt are the most unfavorable of the twelve steps of 10 minutes each one.

33 %Pn
Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
11	12	13	14	15	16	17

SCL Line Filter

AVG Freq Filter

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 600 V/50Hz Element1 Judgement Pass

Un (U1) 230.149V Total Judgement Pass

Freq (U1) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.087 Pass	0.188 Pass	0.0 Pass	0.041 Pass	
2	0.085 Pass	0.159 Pass	0.0 Pass	0.039 Pass	
3	0.110 Pass	0.159 Pass	0.0 Pass	0.048 Pass	
4	0.113 Pass	0.161 Pass	0.0 Pass	0.054 Pass	
5	0.113 Pass	0.153 Pass	0.0 Pass	0.053 Pass	
6	0.115 Pass	0.136 Pass	0.0 Pass	0.058 Pass	
7	0.106 Pass	0.162 Pass	0.0 Pass	0.061 Pass	
8	0.103 Pass	0.137 Pass	0.0 Pass	0.057 Pass	
9	0.104 Pass	0.156 Pass	0.0 Pass	0.056 Pass	
10	0.097 Pass	0.134 Pass	0.0 Pass	0.054 Pass	
11	0.103 Pass	0.162 Pass	0.0 Pass	0.054 Pass	
12	0.099 Pass	0.154 Pass	0.0 Pass	0.057 Pass	
Result	Pass	Pass	Pass	Pass	0.053 Pass

Update: 3646 Runtime: 5:04:42 2020-06-03 13:30:54

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
11	12	13	14	15	16	17

SCL Line Filter

AVG Freq Filter

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 600 V/50Hz Element2 Judgement Pass

Un (U2) 230.110V Total Judgement Pass

Freq (U2) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.004 Pass	0.111 Pass	0.0 Pass	0.142 Pass	
2	0.003 Pass	0.119 Pass	0.0 Pass	0.141 Pass	
3	0.011 Pass	0.101 Pass	0.0 Pass	0.140 Pass	
4	0.012 Pass	0.111 Pass	0.0 Pass	0.140 Pass	
5	0.000 Pass	0.000 Pass	0.0 Pass	0.140 Pass	
6	0.000 Pass	0.000 Pass	0.0 Pass	0.140 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.139 Pass	
8	0.018 Pass	0.158 Pass	0.0 Pass	0.140 Pass	
9	0.014 Pass	0.123 Pass	0.0 Pass	0.139 Pass	
10	0.009 Pass	0.107 Pass	0.0 Pass	0.140 Pass	
11	0.006 Pass	0.102 Pass	0.0 Pass	0.139 Pass	
12	0.009 Pass	0.117 Pass	0.0 Pass	0.140 Pass	
Result	Pass	Pass	Pass	Pass	0.140 Pass

Update: 3650 Runtime: 5:04:51 2020-06-03 13:31:03

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase C

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter

AVG Freq Filter

PA_00002.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 600 V/50Hz Element3 Judgement Pass

Un (U3) 230.213V Total Judgement Pass

Freq (U3) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt			
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12			
No. 1	0.000	Pass	0.000	Pass	0.0	Pass	0.053	Pass
2	0.000	Pass	0.000	Pass	0.0	Pass	0.051	Pass
3	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass
4	0.000	Pass	0.000	Pass	0.0	Pass	0.050	Pass
5	0.017	Pass	0.108	Pass	0.0	Pass	0.050	Pass
6	0.020	Pass	0.106	Pass	0.0	Pass	0.049	Pass
7	0.014	Pass	0.104	Pass	0.0	Pass	0.050	Pass
8	0.057	Pass	0.109	Pass	0.0	Pass	0.050	Pass
9	0.049	Pass	0.108	Pass	0.0	Pass	0.049	Pass
10	0.002	Pass	0.106	Pass	0.0	Pass	0.048	Pass
11	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass
12	0.000	Pass	0.000	Pass	0.0	Pass	0.049	Pass
Result		Pass		Pass		Pass	0.050	Pass

Update: 3655

Runtime: 5:05:00

2020-06-03 13:31:12

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

66 %Pn Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
I1	I2	I3	I4	I5	I6	I7

SCL Line Filter

AVG Freq Filter

PA_00000.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 600 V/50Hz Element1 Judgement Pass

Un (U1) 230.272V Total Judgement Pass

Freq (U1) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt			
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12			
No. 1	0.114	Pass	0.159	Pass	0.0	Pass	0.044	Pass
2	0.068	Pass	0.109	Pass	0.0	Pass	0.037	Pass
3	0.092	Pass	0.132	Pass	0.0	Pass	0.027	Pass
4	0.017	Pass	0.165	Pass	0.0	Pass	0.033	Pass
5	0.098	Pass	0.213	Pass	0.0	Pass	0.025	Pass
6	0.071	Pass	0.133	Pass	0.0	Pass	0.025	Pass
7	0.078	Pass	0.171	Pass	0.0	Pass	0.026	Pass
8	0.104	Pass	0.199	Pass	0.0	Pass	0.032	Pass
9	0.036	Pass	0.151	Pass	0.0	Pass	0.027	Pass
10	0.095	Pass	0.152	Pass	0.0	Pass	0.028	Pass
11	0.081	Pass	0.146	Pass	0.0	Pass	0.030	Pass
12	0.090	Pass	0.144	Pass	0.0	Pass	0.033	Pass
Result		Pass		Pass		Pass	0.032	Pass

Update: 3716

Runtime: 7:39:47

2020-06-03 16:06:00

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Arrêté du 23 avril 2008

Phase B

Flicker Mode
Flicker

Range Over
U1 U2 U3 U4 U5 U6 U7
I1 I2 I3 I4 I5 I6 I7

SCL Line Filter
 AVG Freq Filter

PA_00004.tif

CH: 1 2 3
 4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 600 V/50Hz Element2 Judgement Pass

Un (U2) 230.157V Total Judgement Pass

Freq (U2) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Pit
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.010 Pass	0.119 Pass	0.0 Pass	0.139 Pass	
2	0.007 Pass	0.111 Pass	0.0 Pass	0.138 Pass	
3	0.006 Pass	0.114 Pass	0.0 Pass	0.137 Pass	
4	0.000 Pass	0.000 Pass	0.0 Pass	0.136 Pass	
5	0.007 Pass	0.104 Pass	0.0 Pass	0.136 Pass	
6	0.009 Pass	0.103 Pass	0.0 Pass	0.137 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.136 Pass	
8	0.006 Pass	0.105 Pass	0.0 Pass	0.137 Pass	
9	0.000 Pass	0.000 Pass	0.0 Pass	0.137 Pass	
10	0.011 Pass	0.104 Pass	0.0 Pass	0.136 Pass	
11	0.010 Pass	0.119 Pass	0.0 Pass	0.137 Pass	
12	0.000 Pass	0.000 Pass	0.0 Pass	0.137 Pass	
Result	Pass	Pass	Pass	Pass	0.137 Pass

Update: 3722

Runtime: 7:40:00

51% 10%
2020-06-03 16:06:13

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase C

Flicker Mode
Flicker

Range Over
U1 U2 U3 U4 U5 U6 U7
I1 I2 I3 I4 I5 I6 I7

SCL Line Filter
 AVG Freq Filter

PA_00005.tif

CH: 1 2 3
 4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 600 V/50Hz Element3 Judgement Pass

Un (U3) 230.253V Total Judgement Pass

Freq (U3) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Pit
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.000 Pass	0.000 Pass	0.0 Pass	0.048 Pass	
2	0.000 Pass	0.000 Pass	0.0 Pass	0.047 Pass	
3	0.013 Pass	0.101 Pass	0.0 Pass	0.046 Pass	
4	0.009 Pass	0.101 Pass	0.0 Pass	0.045 Pass	
5	0.000 Pass	0.000 Pass	0.0 Pass	0.046 Pass	
6	0.000 Pass	0.000 Pass	0.0 Pass	0.046 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.046 Pass	
8	0.000 Pass	0.000 Pass	0.0 Pass	0.046 Pass	
9	0.000 Pass	0.000 Pass	0.0 Pass	0.046 Pass	
10	0.020 Pass	0.108 Pass	0.0 Pass	0.046 Pass	
11	0.000 Pass	0.000 Pass	0.0 Pass	0.047 Pass	
12	0.000 Pass	0.000 Pass	0.0 Pass	0.047 Pass	
Result	Pass	Pass	Pass	Pass	0.046 Pass

Update: 3726

Runtime: 7:40:07

51% 10%
2020-06-03 16:06:20

ΣA(3P4W)

U1 600 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 600 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 600 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

100 %Pn
Phase A

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
U1	U2	U3	U4	U5	U6	U7

SCL Line Filter

AVG Freq Filter

CH: 1 2 3

4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 1

Volt Range 300 V/50Hz Element1 Judgement Pass

Un (U1) 230.339V Total Judgement Pass

Freq (U1) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt				
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12				
No. 1	0.103	Pass	0.139	Pass	0.0	Pass	0.058	Pass	
2	0.100	Pass	0.140	Pass	0.0	Pass	0.056	Pass	
3	0.112	Pass	0.141	Pass	0.0	Pass	0.055	Pass	
4	0.103	Pass	0.132	Pass	0.0	Pass	0.054	Pass	
5	0.091	Pass	0.144	Pass	0.0	Pass	0.054	Pass	
6	0.100	Pass	0.168	Pass	0.0	Pass	0.053	Pass	
7	0.096	Pass	0.139	Pass	0.0	Pass	0.052	Pass	
8	0.107	Pass	0.180	Pass	0.0	Pass	0.053	Pass	
9	0.107	Pass	0.173	Pass	0.0	Pass	0.052	Pass	
10	0.127	Pass	0.173	Pass	0.0	Pass	0.052	Pass	
11	0.112	Pass	0.137	Pass	0.0	Pass	0.052	Pass	
12	0.102	Pass	0.155	Pass	0.0	Pass	0.052	Pass	
Result		Pass		Pass		Pass		0.053	Pass

Update: 3757 Runtime: 4:42:50 100% 0% x1 2020-06-06 13:24:37

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase B

Flicker Mode
Flicker

Range Over

U1	U2	U3	U4	U5	U6	U7
U1	U2	U3	U4	U5	U6	U7

SCL Line Filter

AVG Freq Filter

CH: 1 2 3

4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 2

Volt Range 300 V/50Hz Element2 Judgement Pass

Un (U2) 230.370V Total Judgement Pass

Freq (U2) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt				
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12				
No. 1	0.014	Pass	0.106	Pass	0.0	Pass	0.135	Pass	
2	0.008	Pass	0.105	Pass	0.0	Pass	0.135	Pass	
3	0.010	Pass	0.110	Pass	0.0	Pass	0.134	Pass	
4	0.005	Pass	0.120	Pass	0.0	Pass	0.135	Pass	
5	0.032	Pass	0.112	Pass	0.0	Pass	0.135	Pass	
6	0.051	Pass	0.152	Pass	0.0	Pass	0.135	Pass	
7	0.000	Pass	0.000	Pass	0.0	Pass	0.134	Pass	
8	0.007	Pass	0.101	Pass	0.0	Pass	0.134	Pass	
9	0.003	Pass	0.109	Pass	0.0	Pass	0.134	Pass	
10	0.008	Pass	0.112	Pass	0.0	Pass	0.135	Pass	
11	0.000	Pass	0.000	Pass	0.0	Pass	0.134	Pass	
12	0.000	Pass	0.000	Pass	0.0	Pass	0.134	Pass	
Result		Pass		Pass		Pass		0.135	Pass

Update: 3761 Runtime: 4:42:58 100% 0% x1 2020-06-06 13:24:45

ΣA(3P4W)

U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4

U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5

U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

Phase C

Flicker Mode
Flicker

Range Over
U1 U2 U3 U4 U5 U6 U7
I1 I2 I3 I4 I5 I6 I7

SCL Line Filter
 AVG Freq Filter

PA_00011.tif

CH: 1 2 3
4 5 6 7

Count 12/12 Complete

Interval 00:00s/10:00s

Element 3

Volt Range 300 V/50Hz Element3 Judgement Pass

Un (U3) 230.422V Total Judgement Pass

Freq (U3) 50.000Hz (Element1,2,3)

Dmin 0.10%

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.000 Pass	0.000 Pass	0.0 Pass	0.043 Pass	
2	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
3	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
4	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
5	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
6	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
7	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
8	0.000 Pass	0.000 Pass	0.0 Pass	0.042 Pass	
9	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
10	0.000 Pass	0.000 Pass	0.0 Pass	0.039 Pass	
11	0.000 Pass	0.000 Pass	0.0 Pass	0.040 Pass	
12	0.000 Pass	0.000 Pass	0.0 Pass	0.041 Pass	
Result	Pass	Pass	Pass	Pass	0.041 Pass

Update: 3766

Runtime: 4:43:07

138%
10% x1 2020-06-06
13:24:54

ΣA(3P4W)
U1 300 V
I1 50 A
Sync Src: U1
Integral: Reset

U2 300 V
I2 50 A
Sync Src: U1
Integral: Reset

U3 300 V
I3 50 A
Sync Src: U1
Integral: Reset

Element 4
U4 1000 V
I4 50 A
Sync Src: U1
Integral: Reset

Element 5
U5 1000 V
I5 5 A
Sync Src: U1
Integral: Reset

4.2.8 Active Power Constraint

According to the Article 16 of the standard, the equipment shall have the capability to gradually increase or reduce its output power when requested.

When connecting or re-connecting, the gradient of active power injection cannot be greater than 4 MW/min or 66.7 kW/s.

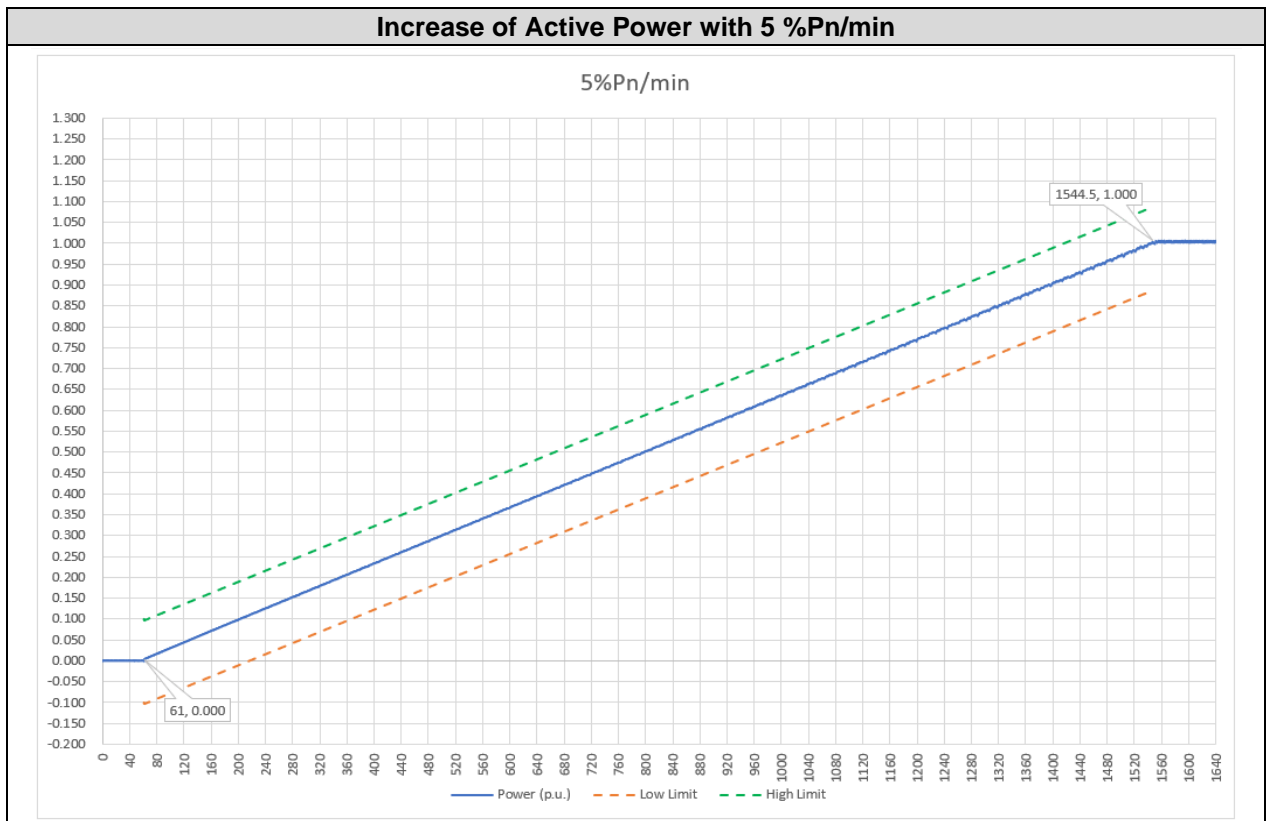
Gradient (ΔP) range can be set from 12.5 W/s to 250 W/s. The following test is performed by setting gradient at 12.5 W/s to 250 W/s

Test results are offered in the table and pictures below:

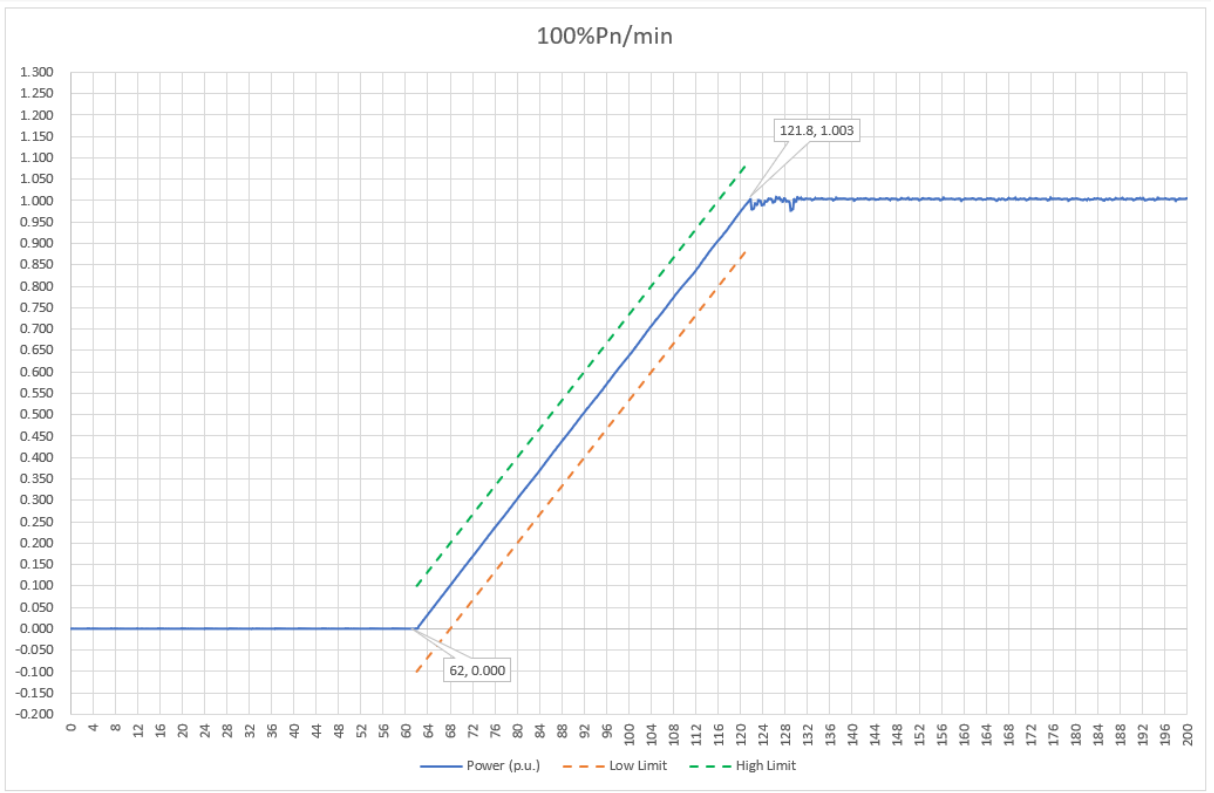
Increase of Active Power			
Gradient (ΔP) desired (W/s)	Nominal Ramp Time (s)	Gradient measured (W/s)	Measured Ramp time (s)
12.5 (5 %Pn/min)	1200.0	10.1	1483.5
250.0 (110 %Pn/min)	60.0	251.6	59.8

Decrease of Active Power			
Gradient (ΔP) desired (W/s)	Nominal Ramp Time (s)	Gradient measured (W/s)	Measured Ramp time (s)
12.5 (5 %Pn/min)	1200.0	10.3	1446.0
250.0 (110 %Pn/min)	60.0	250.9	59.0

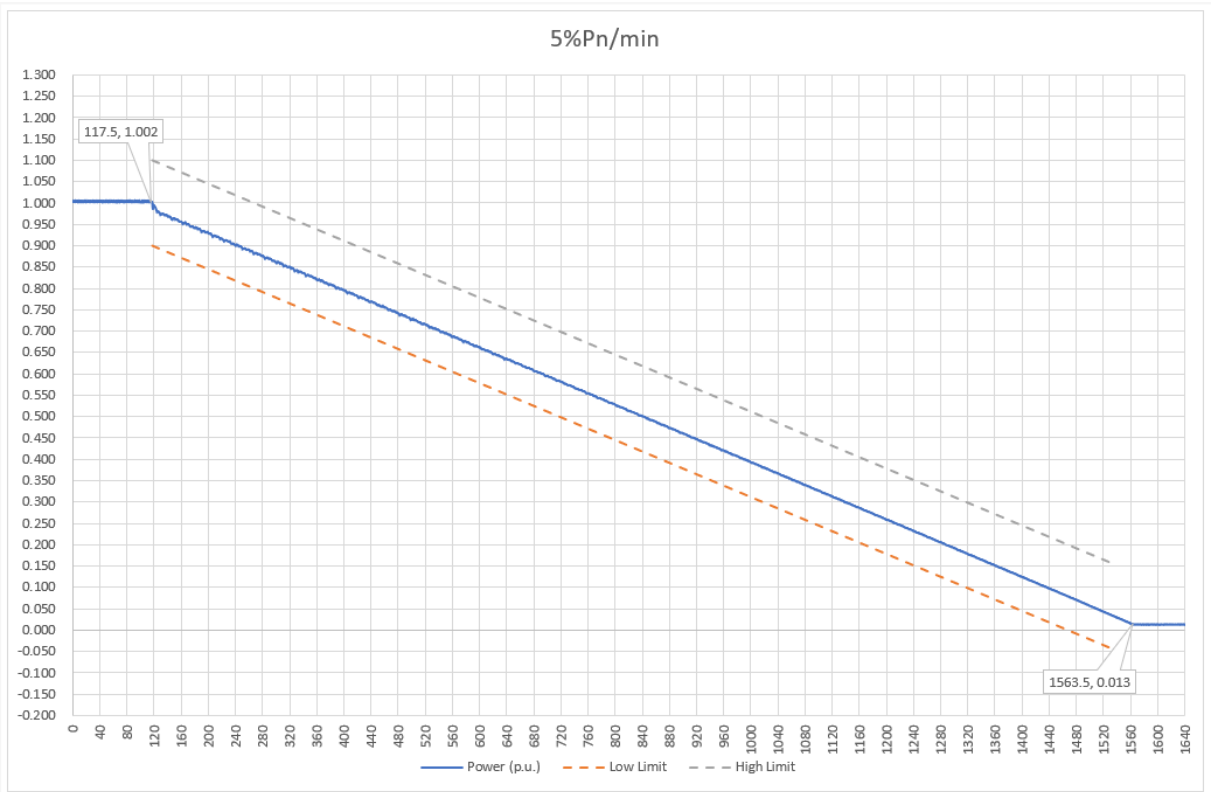
It has been verified that the inverter complies with a maximum non-linearity less than $\pm 10\%$.



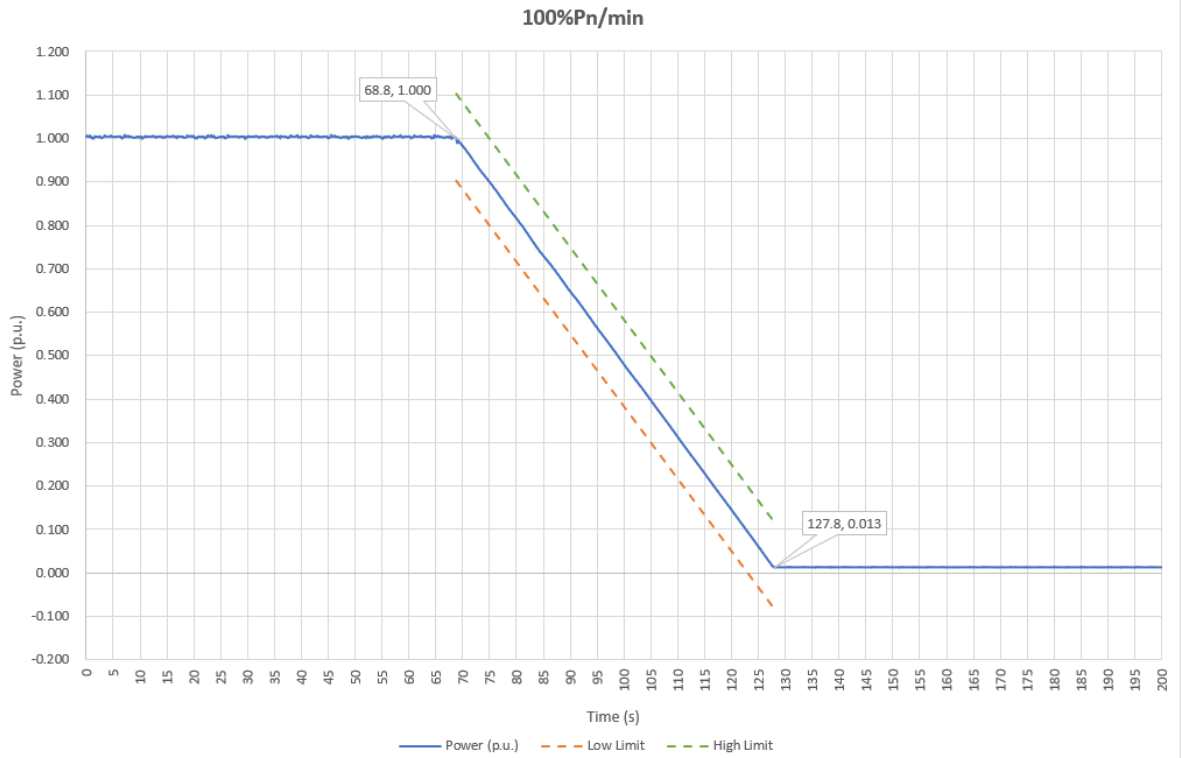
Increase of Active Power with 100 %Pn/min



Decrease of Active Power with 5 %Pn/min



Decrease of Active Power with 100 %Pn/min



4.3 ADDITIONAL TECHNICAL REQUIREMENTS FOR ZNI CONNECTION CASES

4.3.1 Fault Ride Through

Tests to prove the capability to withstand Voltage Faults in the grid for ZNI connection cases have to be performed according to the Article 18-1 of the standard.

It is not applicable due to the inverter is not possible to be connected to a PV plant of $P_{max} > 5$ MW, according to manufacturer Statements.

4.3.2 Voltage and Frequency Operation Ranges

Voltage and Frequency normal operation ranges for ZNI have been verified simultaneously according to prescriptions stated in the Article 20 of the Chapter III of the standard.

They have been taking into account minimum ranges and operations times stated in the Article 19 (frequency) and Article 12 (voltage) of the standard. The inverter must stay connected providing the maximum of its available active power, working in abnormal voltage and/or frequency conditions.

The following tables show the results of the tests performed:

Test 1		Undervoltage + Underfrequency			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
90 %Un	45 Hz	> 80.0 %Pn	100.2 %Pn	0.4 s	> 5 min.
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

Test 2		Undervoltage			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
90 %Un	50 Hz	> 95.0 %Pn	100.2 %Pn	20 min.	> 20 min.
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

Test 3		Underfrequency			
Voltage	Frequency	Active Power desired (p.u.)	Active Power measured	Minimum Operation Time	Time measured
100 %Un	45 Hz	> 80.0 %Pn	100.6 %Pn	0.4 s	> 5 min.
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

Test 4		Underfrequency			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
100 %Un	46 Hz	> 85.0 %Pn	100.6 %Pn	60 s	> 20 min
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

Test 5		Underfrequency			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
100 %Un	47 Hz	> 90.0 %Pn	100.6 %Pn	3 min.	> 5 min
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

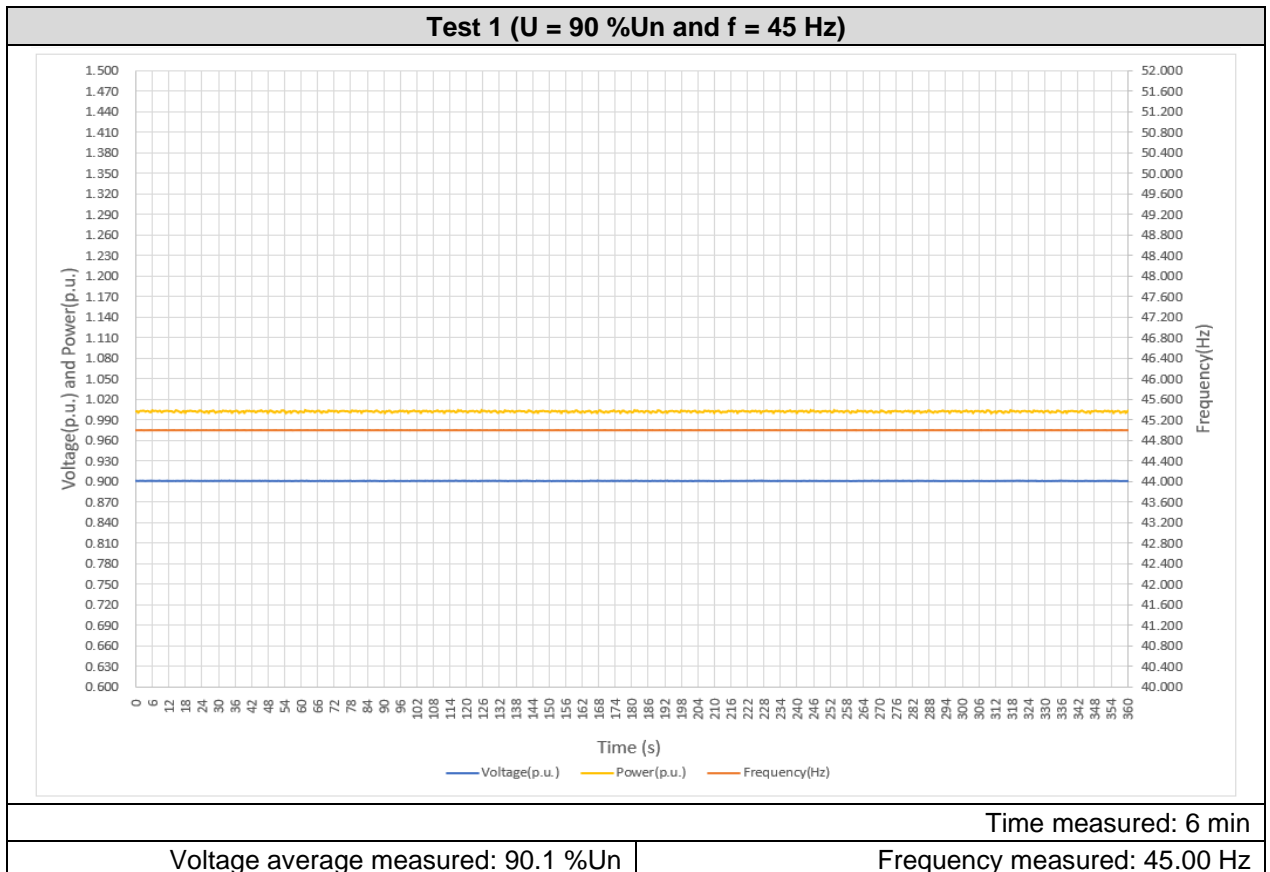
Test 6		Overvoltage + Overfrequency			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
110 %Un	53 Hz	> 80.0 %Pn	100.8 %Pn	5 s	> 5 min
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

Test 7		Overvoltage + Overfrequency			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
110 %Un	52 Hz	> 80.0 %Pn	100.8 %Pn	5 s	> 5 min
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

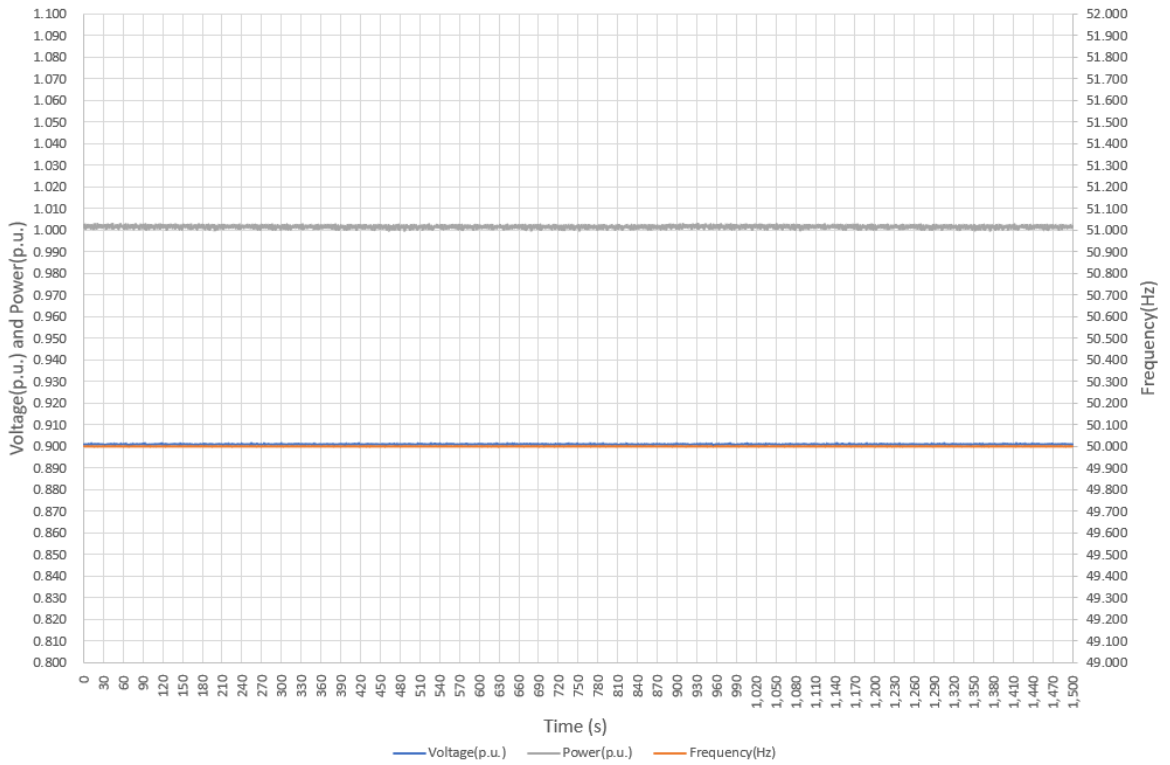
Test 8		Overvoltage + Overfrequency			
Voltage	Frequency	Active Power desired	Active Power measured	Minimum Operation Time	Time measured
105 %Un	52 Hz	> 80.0 %Pn	100.7 %Pn	5 s	> 5 min
Disconnection		<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES			

All tests result above offered have been obtained with the automatic control system for the regulation of active power in front of frequency variations disabled.

As there haven't been measured considerable power losses at the above stated voltage and frequency levels, it is ensured that the inverter is able to provide its maximum capability inside these operation ranges.



Test 2 (U = 90 %Un and f = 50 Hz)

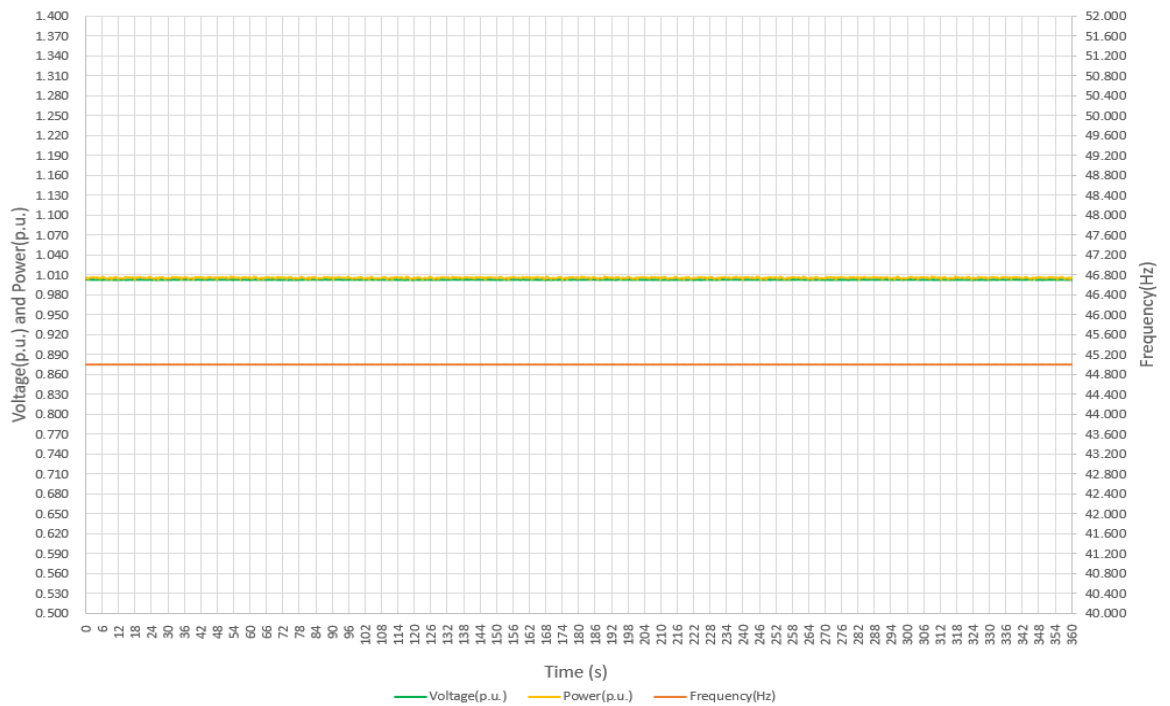


Time measured: 25 min

Voltage average measured: 90.1 %Un

Frequency measured: 50.00 Hz

Test 3 (U = 100 %Un and f = 45 Hz)

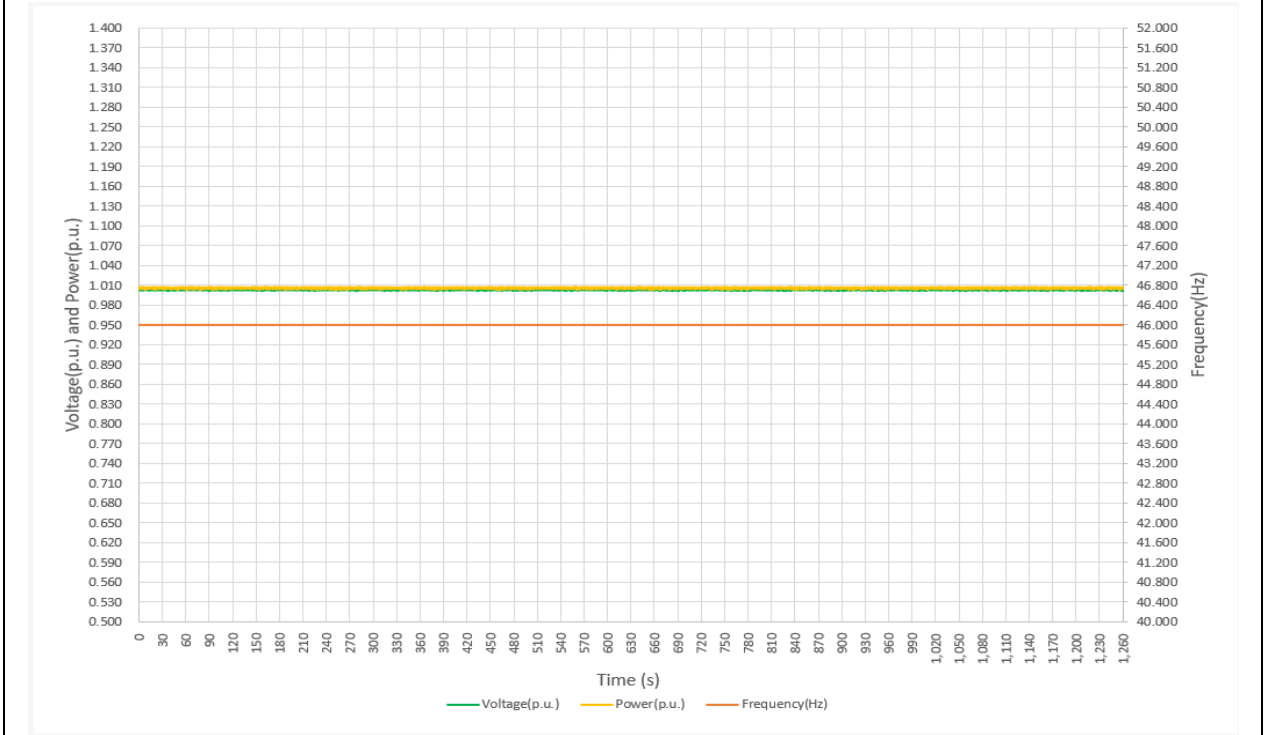


Time measured: 6 min

Voltage average measured: 100.3 %Un

Frequency measured: 45.00 Hz

Test 4 (U = 100 %Un and f = 46 Hz)

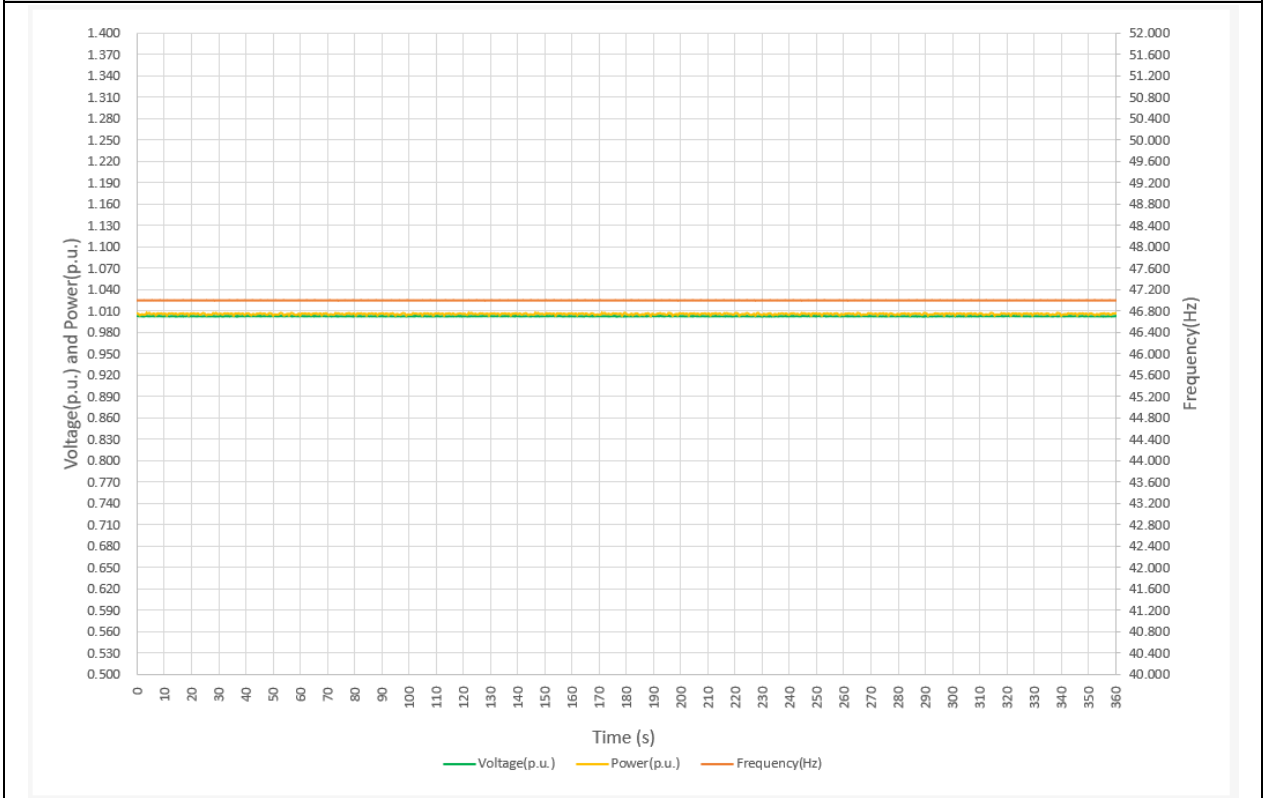


Time measured: 21 min

Voltage average measured: 100.3 %Un

Frequency measured: 46.00 Hz

Test 5 (U = 100 %Un and f = 47 Hz)

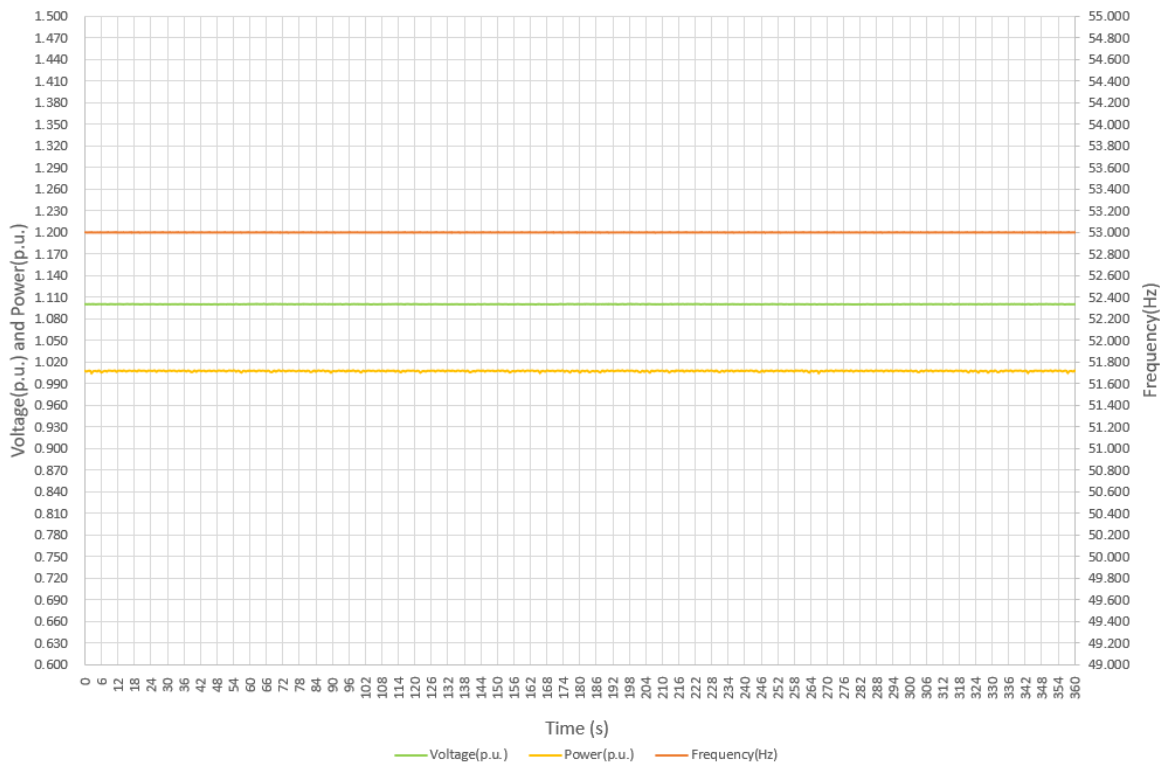


Time measured: 6 min

Voltage average measured: 100.3 %Un

Frequency measured: 47.00 Hz

Test 6 (U = 110 %Un and f = 53 Hz)

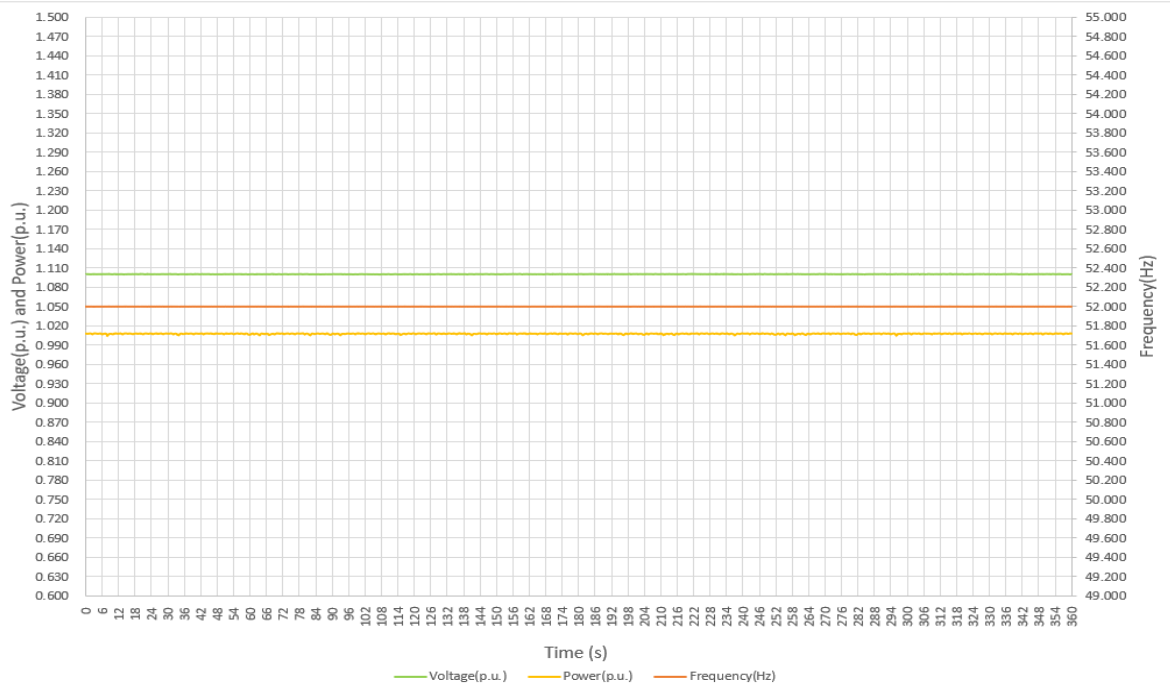


Time measured: 6 min

Voltage average measured: 110.0 %Un

Frequency measured: 53.00 Hz

Test 7 (U = 110 %Un and f = 52 Hz)

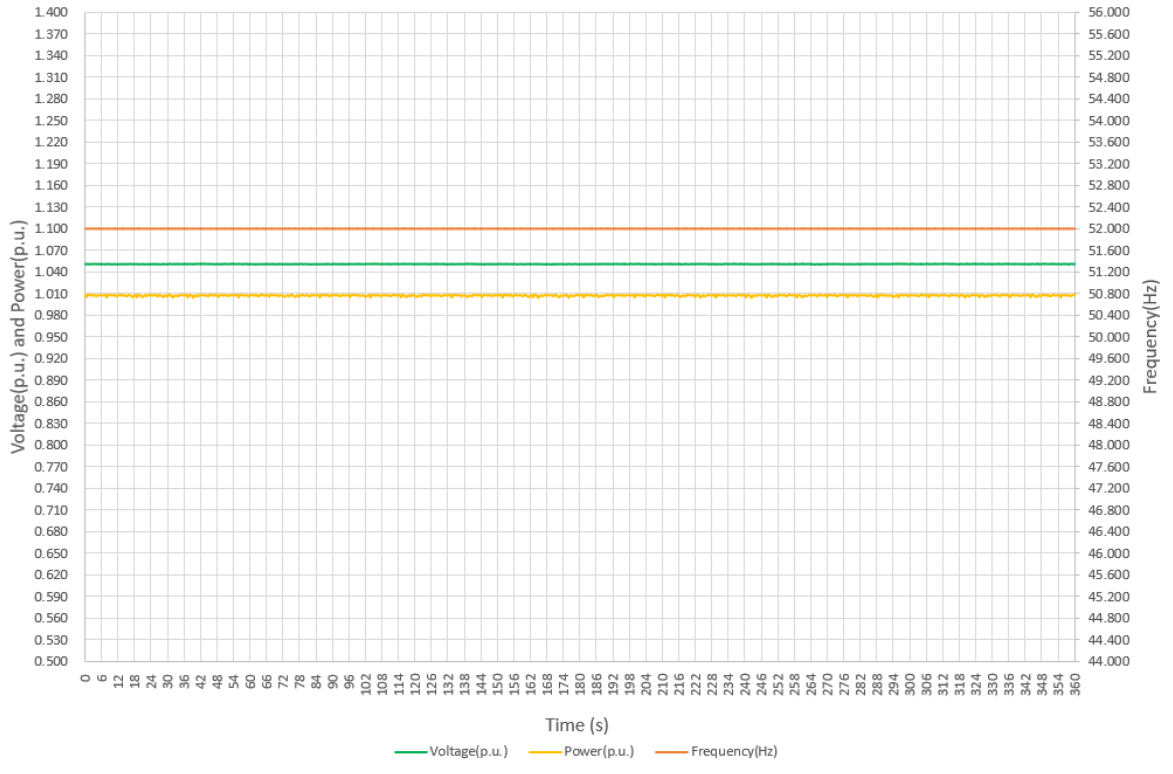


Time measured: 6 min

Voltage average measured: 110.0 %Un

Frequency measured: 52.00 Hz

Test 8 (U = 105 %Un and f = 52 Hz)



Time measured: 6 min

Voltage average measured: 105.1 %Un

Frequency measured: 52.00 Hz

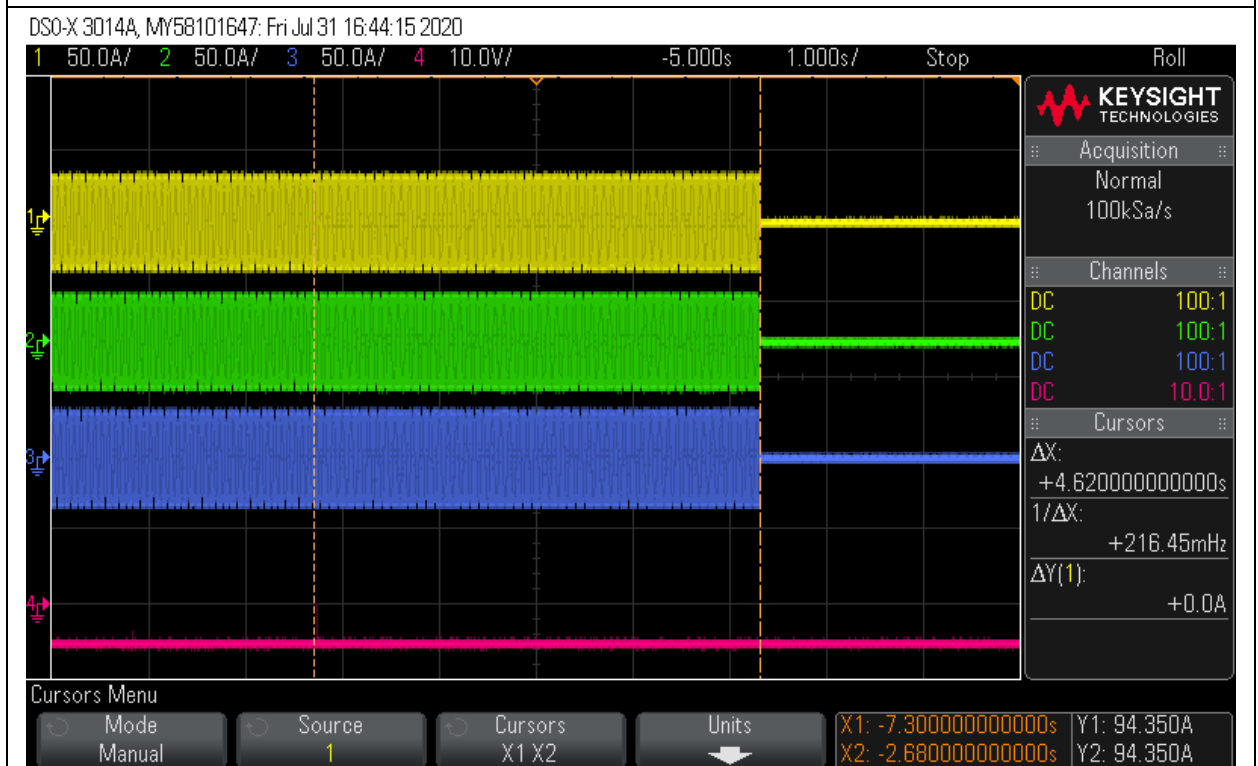
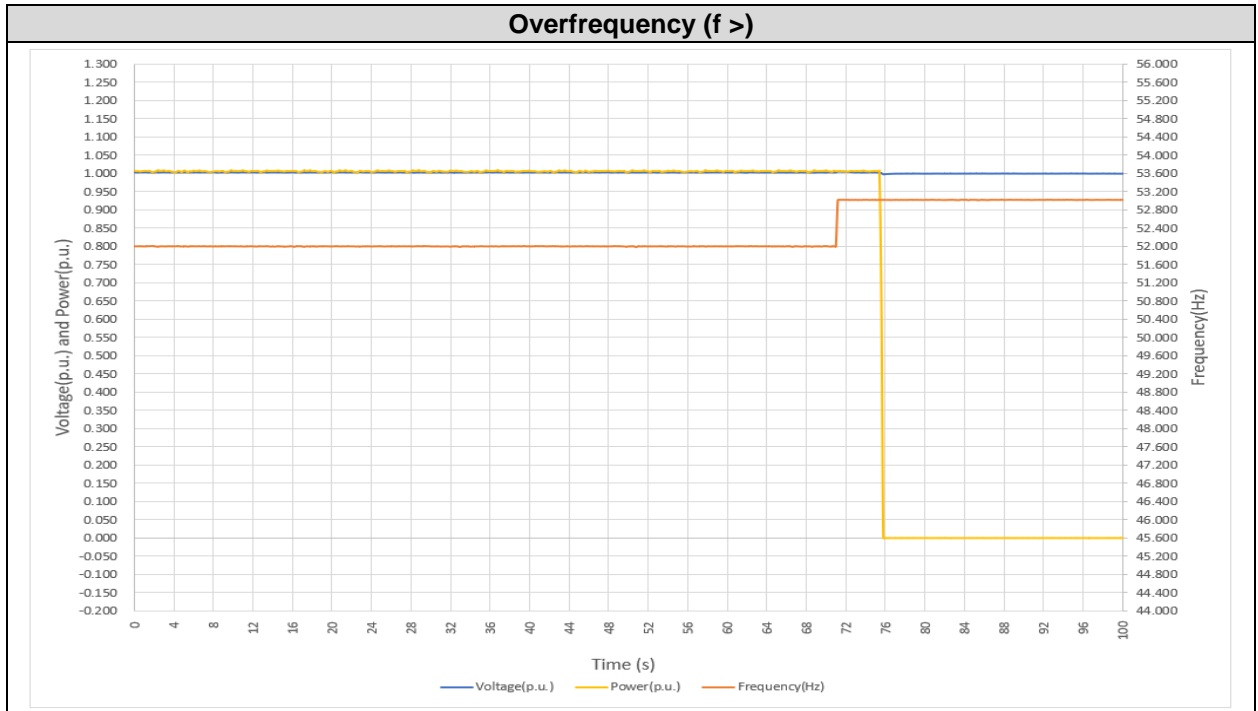
4.3.3 Overfrequency protection

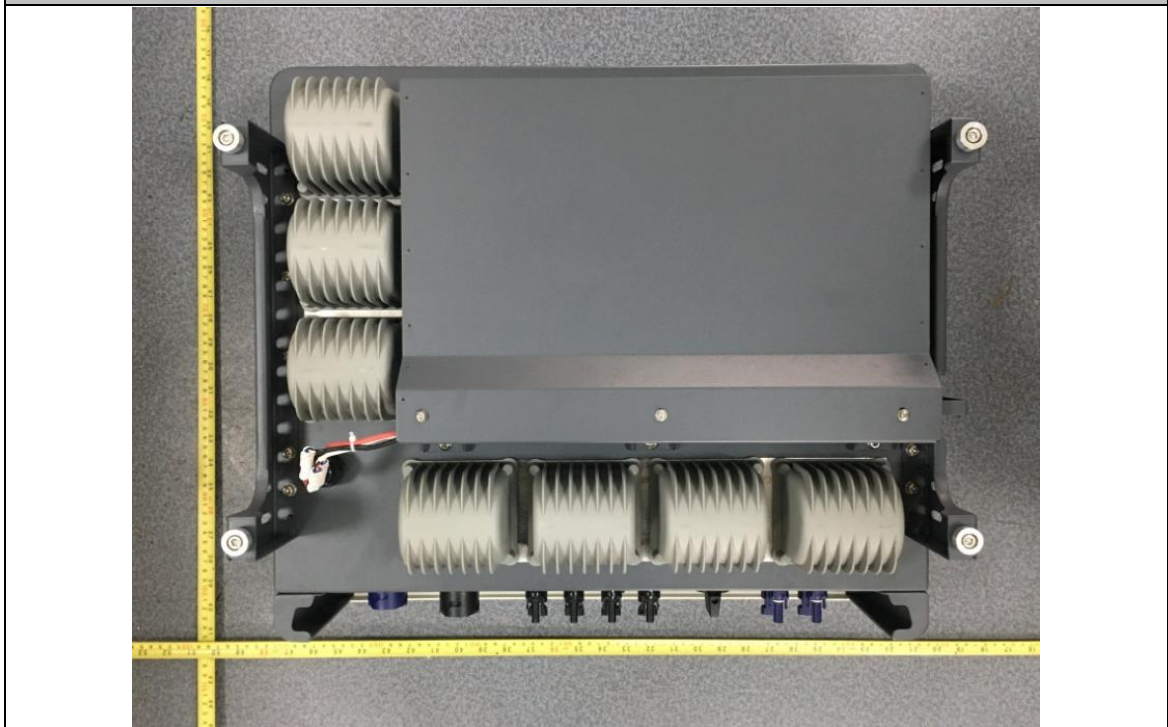
According to the article 19, point ii, of the standard, the protection relay of the inverter shall be able to disconnect the equipment of the grid when frequencies above 53 Hz are detected.

The following table shows the results after the test performed to prove this requirement.

Protective Function Tested	No Trip Test			Trip Test		
	Frequency value (Hz)	Time measured (s)	Trip	Frequency value (Hz)	Trip	Time measured (s)
f >	52.00	>10.0	<input checked="" type="checkbox"/> NO <input type="checkbox"/> YES	53.02	<input type="checkbox"/> NO <input checked="" type="checkbox"/> YES	4.6

The following shows test results evaluated for this test:

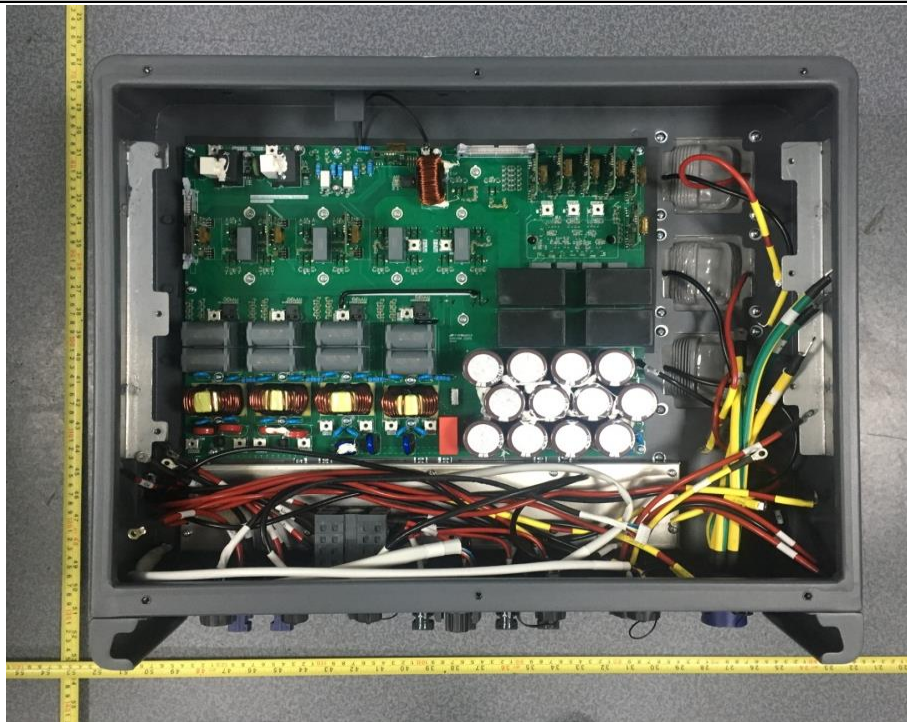


5 PICTURES**Front view****Back view**

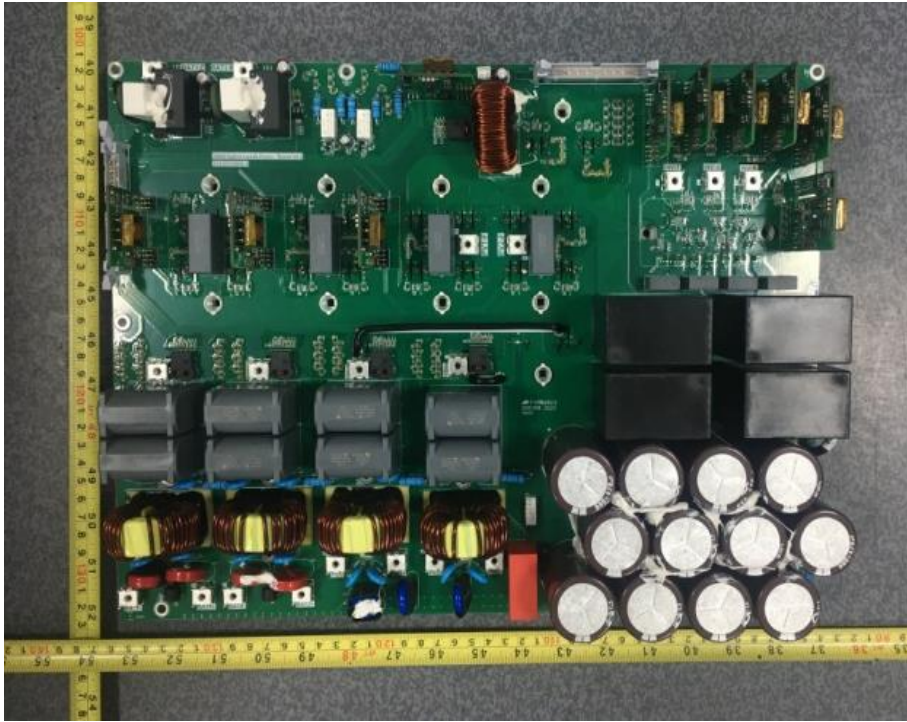
Internal view 1



Internal view 2



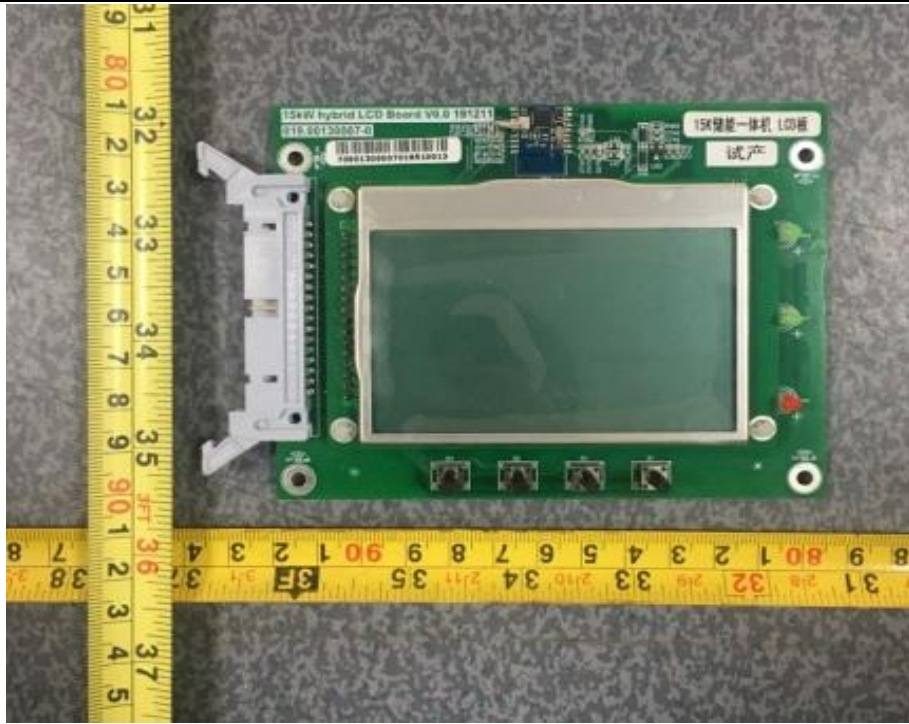
Front side of Power board



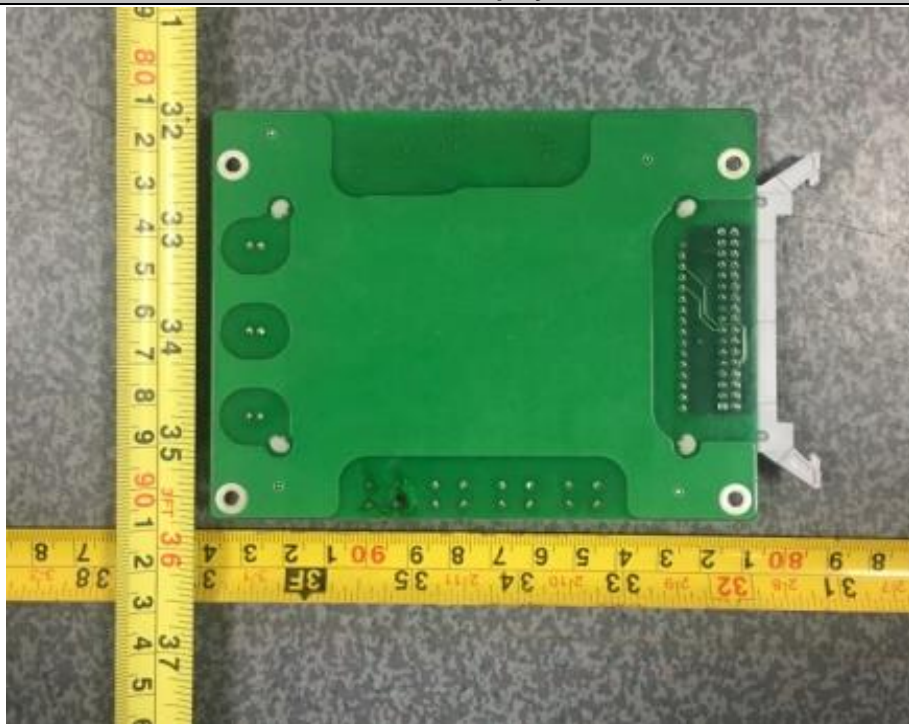
Back side of Power board



Front side of Display board



Back side of Display board



Arrêté du 23 avril 2008

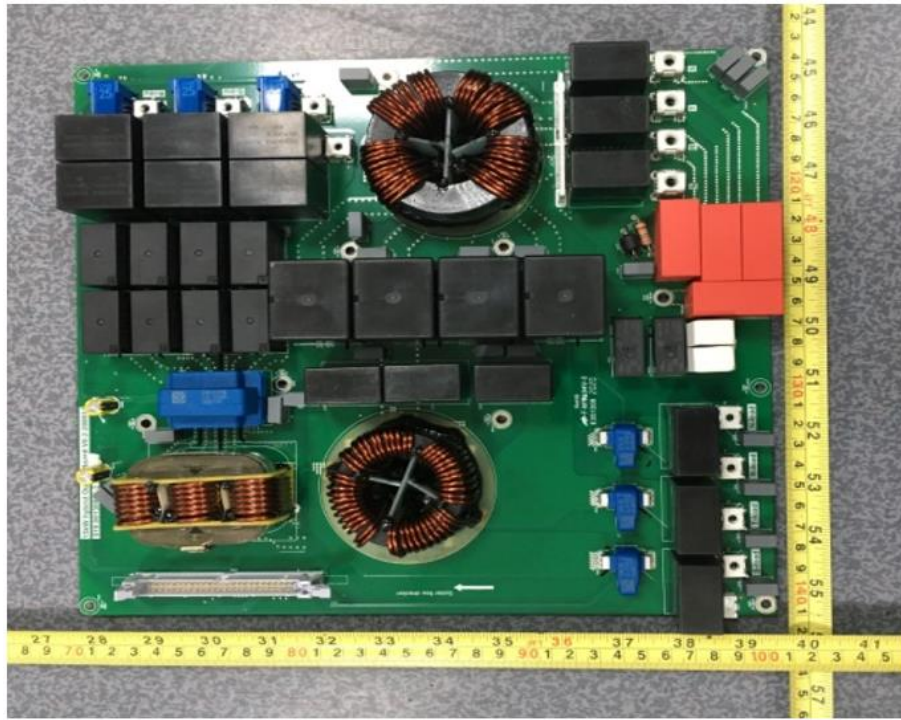
Front side of Control board



Back side of Control board



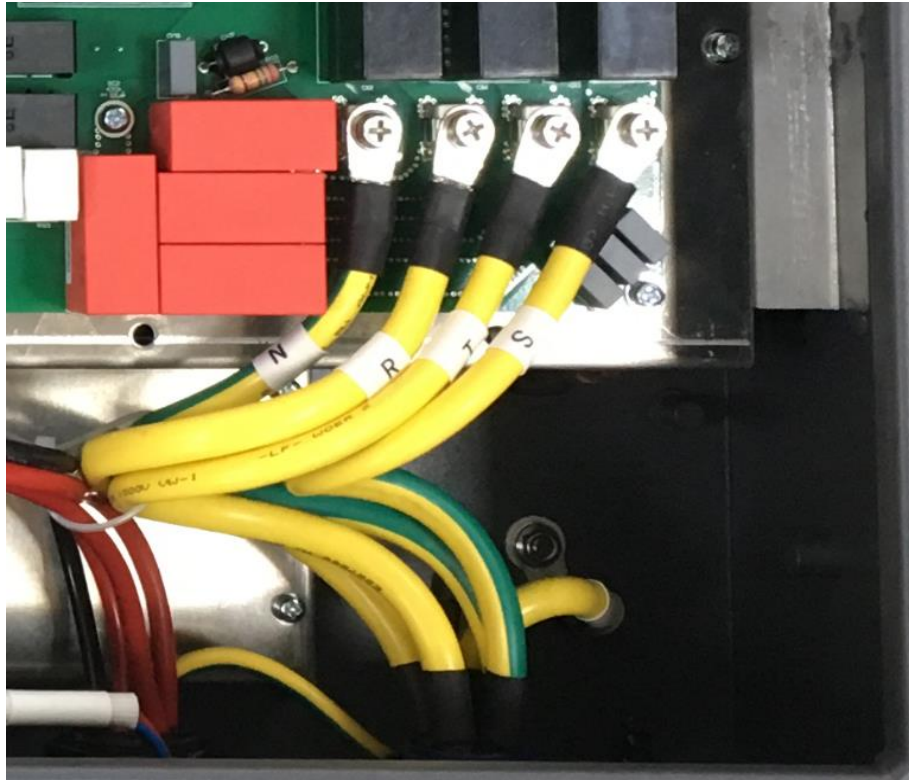
Front side of Output board



Back side of Output board

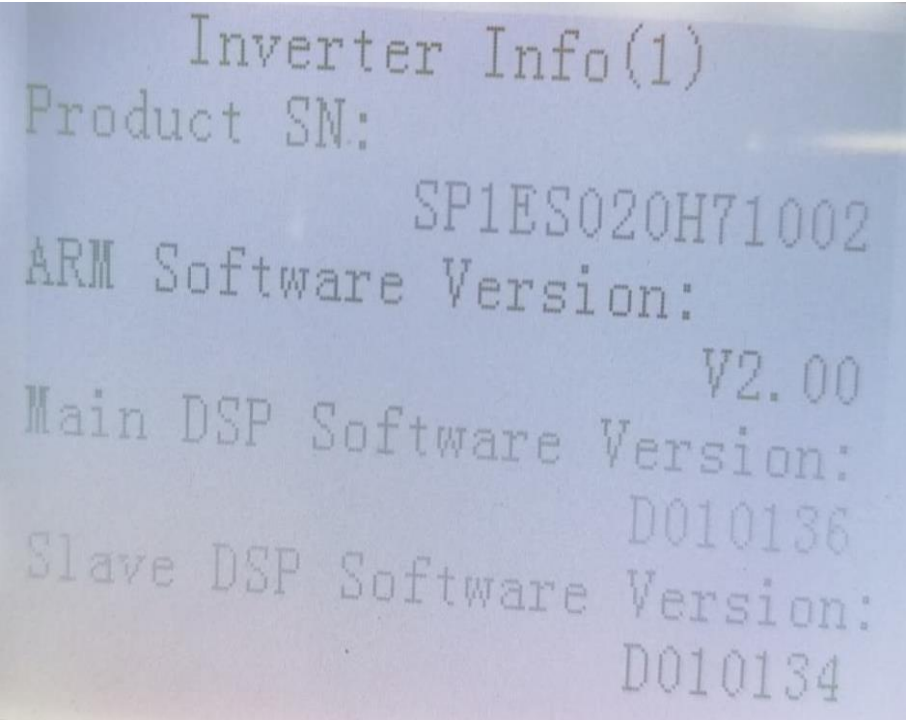


Grounding



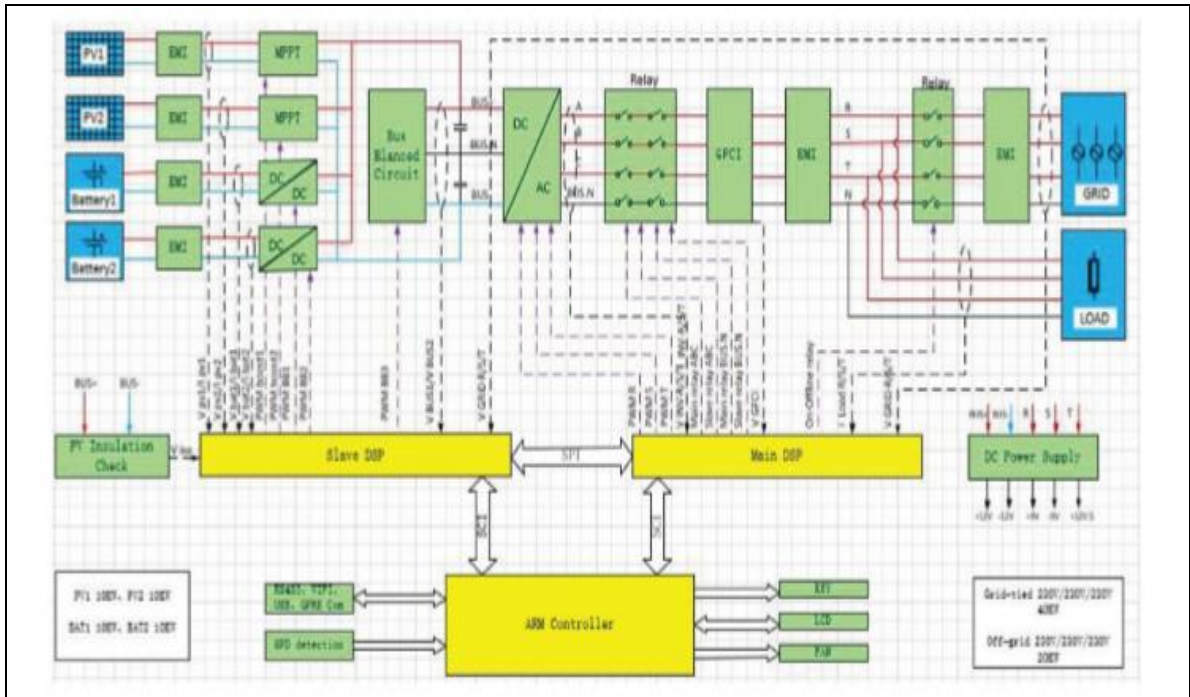
Connection interface



Serial Number and Software Version

Inverter Info(1)
Product SN: SP1ES020H71002
ARM Software Version: V2.00
Main DSP Software Version: D010136
Slave DSP Software Version: D010134

6 ELECTRICAL SCHEMES



7 EMC TYPE EXAMINATION CERTIFICATE



BUREAU
VERITAS

**ATTESTATION
of conformity with European Directives**

Attestation Number: 2088AB0608N033003
 Product: Hybrid Inverter
 Brand Name: SOFAR
 Model: HYD 10KTL-3PH, HYD 20KTL-3PH
 Additional Model: HYD 5KTL-3PH, HYD 6KTL-3PH, HYD 8KTL-3PH, HYD 15KTL-3PH
 Applicant: Shenzhen SOFAR SOLAR Co., Ltd.
 Address: 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China.
 Technical Characteristics: DC Input: 200-1000V 50A max
 AC Output: 400V or 380V
 Battery port input/output: DC 180-800V

The submitted sample of the above equipment has been tested for **CE** marking according to following European Directive and standards:

- Electromagnetic Compatibility Directive 2014/30/EU

Standards	Report Number	Report date
<input checked="" type="checkbox"/> EN 61000-6-3:2007+A1:2011+AC:2012	CE200608N033	Jun. 24, 2020
<input checked="" type="checkbox"/> EN 61000-3-12:2011		
<input checked="" type="checkbox"/> EN 61000-3-11:2001		
<input checked="" type="checkbox"/> EN IEC 61000-3-2:2019		
<input checked="" type="checkbox"/> EN 61000-3-3:2013+A1:2019		
<input checked="" type="checkbox"/> EN 61000-6-2:2005		

The referred test report(s) show that the product complies with standard(s) recognized as giving presumption of compliance with the essential requirements in the specified European Directive. This verification does not imply assessment of the production of the product. The **CE** marking may be affixed if all relevant and effective European Directives with **CE** are applicable.

Assistant Manager
EMC Department



Name: Glyn He
Date: Jun. 24, 2020

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Information given in this document is related to the tested specimen of the described electrical sample.

Bureau Veritas Shenzhen Co., Ltd.
Dongguan Branch

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