



TEST REPORT

IEC 61727

Photovoltaic (PV) systems
Characteristics of the utility interface

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

LCIE

Report reference number: ABRE-18SE0635FC SHP-2

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Testing laboratory name: Bureau Veritas
LCIE China Company Limited

Address: Building 4, No, 518, Xinzhuan
Road, Caohejing Songjiang
High-Tech Park, Shanghai,
P,R, China (201612)



Test specification

Standard: IEC 61727:2004

Certificate: Certificate of compliance


Test report form number: IEC 61727

Master TRF: Bureau Veritas Consumer Products Services Germany GmbH

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Model / Type: NAC20K-DT, NAC25K-DT, NAC30K-DT, NAC33K-DT

Model / Type	NAC20K-DT	NAC25K-DT	NAC30K-DT	NAC33K-DT
MPP DC voltage range [V]	250-950			
Max, Input DC voltage [V]	1000			
Max, Input DC current [A].....	20/20	20/30	30/30	
Output AC voltage [V]	230, 3/N/PE, 50/60Hz			
Max, Output AC current [A]	32(per phase)	40(per phase)	43(per phase)	48(per phase)
Max, Output power [kVA]	22	27,6	30	33

Testing Location	Bureau Veritas LCIE China Company Limited		
Address	Building 4, No, 518, Xinzhuan Road, Caohejing, Songjiang High-Tech Park, Shanghai, P,R, China (201612)		
Tested by (name and signature)	Tony Huang Test engineer		
Approved by (name and signature)	Harvey Wang Project Manager		
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Document History			
Date	Internal reference	Modification / Change / Status	Revision
2018-12-08	Tony Huang	Initial report was written	0
Supplementary information:			

Test items particulars

Equipment mobility: Permanent connection
Operating condition: Continuous
Class of equipment: Class I
Protection against ingress of water ..: IP65 according to EN 60529
Mass of equipment [kg]: 38kg for all model

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: 2018-09-12
Date(s) of performance test: 2018-09-12 to 2018-12-05

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

The IEC61727 does not provide any limits of accuracy for the utility voltage and frequency measurement of the PV-system, If nothing different stated at the test table the values for tolerances given in EN 50438, Table 2 are used,

Tolerances on trip values tabel 2 EN50438:

- Voltage: +/- 1% of the nominal voltage
- Frequency: +/- 0,5% of the nominal frequency
- Clearance time: +/- 10%

This Test Report consists of the following documents:




1. Test Results
2. Annex No, 1 – EMC Test Report
3. Annex No, 2 – Pictures of the unit
4. Annex No, 3 – Test equipment list

Copy of marking plate:

EMPALUX

Model: NAC20K-DT

DC	Max. DC Power	26000W
	Max. Input Voltage	1000Vdc
	MPP Operating Voltage Range	250-950Vdc
	Rated MPP Voltage	630Vdc
	Max. Input Current Per MPPT	20A/20A
	Isc	26Adc/26Adc
AC	Rated AC Power	20000VA
	Max. AC Power	22000VA
	Rated Grid Frequency	50Hz/60Hz±5Hz
	Rated AC Voltage	230/400Vac, 3+N+PE/3+PE
	Max. AC Current	32A
	Power Factor	0.8(lagging)~0.8(leading)
Protection Class		IP65
Operating Ambient Temperature		-25~60 °C
Enclosure		Class1








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EMPALUX

Model: NAC25K-DT

DC	Max. DC Power	32500W
	Max. Input Voltage	1000Vdc
	MPP Operating Voltage Range	250-950Vdc
	Rated MPP Voltage	630Vdc
	Max. Input Current Per MPPT	20A/30A
	Isc	26Adc/39Adc
AC	Rated AC Power	25000VA
	Max. AC Power	27600VA
	Rated Grid Frequency	50Hz/60Hz±5Hz
	Rated AC Voltage	230/400Vac, 3+N+PE/3+PE
	Max. AC Current	40A
	Power Factor	0.8(lagging)~0.8(leading)
Protection Class		IP65
Operating Ambient Temperature		-25~60 °C
Enclosure		Class1








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EMPALUX

Model: NAC30K-DT

DC	Max. DC Power	37000W
	Max. Input Voltage	1000Vdc
	MPP Operating Voltage Range	250-950Vdc
	Rated MPP Voltage	630Vdc
	Max. Input Current Per MPPT	30A/30A
	Isc	39Adc/39Adc
AC	Rated AC Power	30000VA
	Max. AC Power	30000VA
	Rated Grid Frequency	50Hz/60Hz±5Hz
	Rated AC Voltage	230/400Vac, 3+N+PE/3+PE
	Max. AC Current	43A
	Power Factor	0.8(lagging)~0.8(leading)
Protection Class		IP65
Operating Ambient Temperature		-25~60 °C
Enclosure		Class1








MADE IN CHINA

EMPALUX

Model: NAC33K-DT

DC	Max. DC Power	39000W
	Max. Input Voltage	1000Vdc
	MPP Operating Voltage Range	250-950Vdc
	Rated MPP Voltage	630Vdc
	Max. Input Current Per MPPT	30A/30A
	Isc	39Adc/39Adc
AC	Rated AC Power	33000VA
	Max. AC Power	33000VA
	Rated Grid Frequency	50Hz/60Hz±5Hz
	Rated AC Voltage	230/400Vac, 3+N+PE/3+PE
	Max. AC Current	48A
	Power Factor	0.8(lagging)~0.8(leading)
Protection Class		IP65
Operating Ambient Temperature		-25~60 °C
Enclosure		Class1

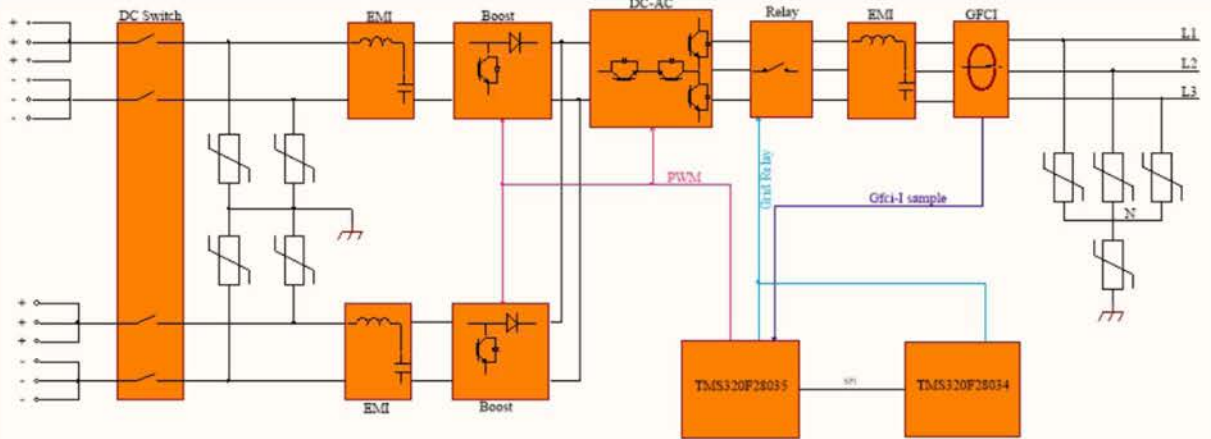




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General product information:

The Solar converter converts DC voltage into AC voltage, The input and output are protected by varistors to earth, The unit is providing EMC filtering at the input and output towards mains, The output is switched off redundant by the high power switching bridge and two relay in series, This assures that the opening of the output circuit will also operate in case of one error,

Block diagram



Description of the power circuit :

The internal control is redundant built, It consists of master controller(U20) and slave controller(UC73), the master controller(U20) can control relays, measures voltage, frequency, AC current with injected DC, insulation resistance and residual current, The slave controller (UC73) can control the relays, measures the voltage and frequency, Both controllers communicate with each other, The voltage and frequency measurement is achieved with resistors in serial which are connected directly to line and neutral, Both controllers get these signals and calculate the data, The unit provides two relays in series in each phase, The relays are tested before each start up, In addition the power bridge can be stopped by both controllers,

Hardware Version:

Model	NAC20K-DT, NAC25K-DT, NAC30K-DT, NAC33K-DT
Hardware version	V1,00

Software Version:

Model	NAC20K-DT, NAC25K-DT, NAC30K-DT, NAC33K-DT
Software version	V1,00

Description of the differences of the models within a series:

Model	NAC20K-DT	NAC25K-DT	NAC30K-DT	NAC33K-DT
Number of input port for each MPPT	2+2	2+3	3+3	
External fan	N	N	N	Y

N:haven't external fan Y:have external fan

Note:

The product was tested on:

The tests had been performed on model NAC33K-DT are valid for model NAC20K-DT, NAC25K-DT, NAC30K-DT since it is identical in hardware and just power derated by except for the type of PV and external fan,

Default interface protection settings according IEC 61727:2004

TNB Technical Guidebook on Grid-interconnection of Photovoltaic Power Generations System to LV and MV Networks:2013

Parameter	Max, clearance time*	Trip setting
Over voltage (level 2)	0,05s	230V +35% (310,5V)
Over voltage (level 1)	2,0s	230V +10% (253V)
Under voltage (level 1)	2,0s	230V -15% (195,5V)
Under voltage (level 2)	0,1s	230V -50% (115V)
Over frequency	0,2s	50Hz +2% (51,0Hz)
Under frequency	0,2s	50Hz -2% (49,0Hz)
Reconnection time	20s to 300s	
Permanent DC-injection	1% of rated inverter output current	
Loss of main IEC 62116:2008	Inverter shall detect and disconnect within 2s	

* Trip time refers to the time between the abnormal condition occurring and the inverter ceasing to energize the utility line, The PV system control circuits shall actually remain connected to the utility to allow sensing of utility electrical conditions for use by the "reconnect" feature,

IEC61727:2004			
Clause	Requirement – Test	Result – Remark	Verdict
SECTION 4: Utility compatibility			
4	General The quality of power provided by the PV system for the on-site AC loads and for power delivered to the utility is governed by practices and standards on voltage, flicker, frequency, harmonics and power factor, Deviation from these standards represents out-of-bounds conditions and may require the PV system to sense the deviation and properly disconnect from the utility system, All power quality parameters (voltage, flicker, frequency, harmonics, and power factor) must be measured at the utility interface/ point of common coupling unless otherwise specified,	Noticed	P
4,1	Voltage, current and frequency The PV system AC voltage, current and frequency shall be compatible with the utility system,	Derived from tests	P
4,2	Normal voltage operating range Utility-interconnected PV systems do not normally regulate voltage; they inject current into the utility, Therefore, the voltage operating range for PV inverters is selected as a protection function that responds to abnormal utility conditions, not as a voltage regulation function,	Derived from tests	P
4,3	Flicker The operation of the PV system should not cause voltage flicker in excess of limits stated in the relevant sections of IEC 61000-3-3 for systems less than 16 A or IEC 61000-3-5 for systems with current of 16 A and above,	See table 4,3	P
4,4	DC injection The PV system shall not inject DC current greater than 1 % of the rated inverter output current, into the utility AC interface under any operating condition,	See table 4,4	P
4,5	Normal frequency operating range The PV system shall operate in synchronism with the utility system, and within the frequency trip limits defined in 5,2,2,	See table 4,5 and 5,2,2	P

IEC61727:2004			
Clause	Requirement – Test	Result – Remark	Verdict
SECTION 4: Utility compatibility			
4,6	Harmonics and waveform distortion Low levels of current and voltage harmonics are desirable; the higher harmonic levels increase the potential for adverse effects on connected equipment, Acceptable levels of harmonic voltage and current depend upon distribution system characteristics, type of service, connected loads/apparatus, and established utility practice, The PV system output should have low current-distortion levels to ensure that no adverse effects are caused to other equipment connected to the utility system, Total harmonic current distortion shall be less than 5 % at rated inverter output, Each individual harmonic shall be limited to the percentages listed in Table 1, Even harmonics in these ranges shall be less than 25 % of the lower odd harmonic limits listed, (see Clause 4,6 Table 1 – Current distortion limits)	See tables 4,6 and Annex No,1	P
4,7	Power factor The PV system shall have a lagging power factor greater than 0,9 when the output is greater than 50 % of the rated inverter output power,	See table 4,7	P

IEC61727:2004			
Clause	Requirement – Test	Result – Remark	Verdict
SECTION 5: Personnel safety and equipment protection			
5	General This Clause provides information and considerations for the safe and proper operation of the utility-connected PV systems,	Noticed	P
5,1	Loss of utility voltage To prevent islanding, a utility connected PV system shall cease to energize the utility system from a de-energized distribution line irrespective of connected loads or other generators within specified time limits, A utility distribution line can become de-energized for several reasons, For example, a substation breaker opening due to fault conditions or the distribution line switched out during maintenance, If inverters (single or multiple) have DC SELV input and have accumulated power below 1 kW then no mechanical disconnect (relay) is required,	The loss of utility voltage test report for IEC61727 according to IEC62116 is stored in archive at Bureau Veritas LCIE China Company Limited,	P
5,2	Over/under voltage and frequency Abnormal conditions can arise on the utility system that requires a response from the connected photovoltaic system, This response is to ensure the safety of utility maintenance personnel and the general public, as well as to avoid damage to connected equipment, including the photovoltaic system, The abnormal utility conditions of concern are voltage and frequency excursions above or below the values stated in this Clause, and the complete disconnection of the utility, presenting the potential for a distributed resource island,	See table 5,2,1 and 5,2,2	P
5,2,1	Over/under voltage When the interface voltage deviates outside the conditions specified in Table 2, the photovoltaic system shall cease to energize the utility distribution system, This applies to any phase of a multiphase system, All discussions regarding system voltage refer to the local nominal voltage, The system shall sense abnormal voltage and respond, The following conditions should be met, with voltages in RMS and measured at the point of utility connection, (see clause 5,2,1 Table 2 – Response to abnormal voltages) The purpose of the allowed time delay is to ride through short-term disturbances to avoid excessive nuisance tripping, The unit does not have to cease to energize if the voltage returns to the normal utility continuous operation condition within the specified trip time,	See table 5,2,1	P

IEC61727:2004			
Clause	Requirement – Test	Result – Remark	Verdict
SECTION 5: Personnel safety and equipment protection			
5,2,2	Over/under frequency When the utility frequency deviates outside the specified conditions the photovoltaic system shall cease to energize the utility line, The unit does not have to cease to energize if the frequency returns to the normal utility continuous operation condition within the specified trip time, When the utility frequency is outside the range of ± 1 Hz, the system shall cease to energize the utility line within 0,2 s, The purpose of the allowed range and time delay is to allow continued operation for short-term disturbances and to avoid excessive nuisance tripping in weak-utility system conditions,	See table 5,2,2	P
5,3	Islanding protection The PV system must cease to energize the utility line within 2 s of loss of utility,	The loss of utility voltage test report for IEC61727 according to IEC62116 is stored in archive at Bureau Veritas LCIE China Company Limited,	P
5,4	Response to utility recovery Following an out-of-range utility condition that has caused the photovoltaic system to cease energizing, the photovoltaic system shall not energize the utility line for 20 s to 5 min after the utility service voltage and frequency have recovered to within the specified ranges,	See table 5,2 (1) and 5,2 (2)	P
5,5	Earthing The utility interface equipment shall be earthed/grounded in accordance with IEC 60364-7-712,	Stated in the manual,	P
5,6	Short circuit protection The photovoltaic system shall have short-circuit protection in accordance with IEC 60364-7-712,	Stated in the manual,	P
5,7	Isolation and switching A method of isolation and switching shall be provided in accordance with IEC 60364-7-712,	Stated in the manual,	P

Test overview:

IEC 61727:2004

Clause		Result
1	Response to protection operation - fault condition tests (according VDE0126-1-1:2006)	P
4	Type test:	
4,3	Voltage Fluctuations and Flicker	P
4,4	Monitoring of DC-Injection	P
4,5	Normal frequency operating range (see 5,2,2 below)	P
4,6	Harmonics and waveform distortion	P
4,7	Power factor	P
5,2,1	Voltage monitoring	P
5,2,2	Frequency monitoring	P

Test Results

1, Response to protection operation - fault condition tests								P
	ambient temperature [°C] :	24,0°C						—
	model/type of power supply :	AC: type 61512 DC: type 62150H-1000S						—
	manufacturer of power supply :	AC: Chroma DC: Chroma						—
	rated markings of power supply :	AC: 18kW three phase DC: 15kW, 15A, 1000V						—
component No,	fault	test condition		test time	fuse No,	fault condition		result
		AC	DC			AC	DC	
PV+ to PV-	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
PV+ to PV-	Reverse	230V 48A*3	600V 56A	3min	--	230V 0A	3,3V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Output L1 to N	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Output L2 to N	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Output L3 to N	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Output L to N	Reverse	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Output	Overload 120%	230V 48A*3	600V 67,2A	10min		230V 48A*3	600V 67,2A	Unit normal operation, no damage, no hazard, no fire

RY1	short circuit before start up	230V 0A	600V 0A	3min	--	230V 0A	600V 0A	Unit can't start up, no damage, no hazard, no fire
RY2	short circuit before start up	230V 0A	600V 0A	3min	--	230V 0A	600V 0A	Unit can't start up, no damage, no hazard, no fire
RY3	short circuit before start up	230V 0A	600V 0A	3min	--	230V 0A	600V 0A	Unit can't start up, no damage, no hazard, no fire
TXD1 Pin 6 to Pin 7	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
TXD1 Pin 9 to Pin 10	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
TC1 Pin 9 to Pin 10	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, LCD light is not on, no damage, no hazard, no fire
TC1 Pin 11 to Pin 10	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, LCD light is not on, no damage, no hazard, no fire
TC1 Pin 16 to Pin 14	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, LCD light is not on, no damage, no hazard, no fire
TC1 Pin 15 to Pin 14	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, LCD light is not on, no damage, no hazard, no fire
Bus cap CD5	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
Bus cap ECD4	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, hazard, no fire
QD6 Pin G to Pin S	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire

QD6 Pin G to Pin D	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
QD6 Pin D to Pin S	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
IGBT2D Pin 7 to Pin 6	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
IGBT2D Pin 7 to Pin 5	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
IGBT2D Pin 5 to Pin 6	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
IGBT3D Pin 7 to Pin 6	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
IGBT3D Pin 7 to Pin 5	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
IGBT3D Pin 5 to Pin 6	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
IGBT1D Pin 7 to Pin 6	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
IGBT1D Pin 7 to Pin 5	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
IGBT1D Pin 5 to Pin 6	short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, damage, no hazard, no fire
Insulate Optocoupler UC67 Pin 1 to Pin 2	short circuit before start up	230V 48A*3	600V 56A	3min	--	230V 48A*3	600V 56A	Unit normal operation, screen can't be displayed, no damage, no hazard, no fire

Drive Optocoupler UD2 Pin2 to Pin3	short circuit before start up	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
voltage resistance INV_ N monitoring, RB37	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
voltage resistance INV_ N monitoring, RB37	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
BUS voltage resistance + monitoring, RD1	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
BUS voltage resistance + monitoring, RD1	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
BUS voltage resistance - monitoring, RD1	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
BUS voltage resistance - monitoring, RD1	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance R monitoring, RB19	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance R monitoring, RB19	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance S monitoring, RB25	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance S monitoring, RB25	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance T monitoring, RB31	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire

Grid voltage resistance T monitoring, RB31	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance N monitoring, RB111	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Grid voltage resistance N monitoring, RB111	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
voltage resistance PV1-monitoring, RA13	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
voltage resistance PV1-monitoring, RA13	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
voltage resistance PV2-monitoring, RA16	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
voltage resistance PV2-monitoring, RA16	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
ISO - monitoring RC81	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
ISO - monitoring RC81	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
GFCI monitoring RC159	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
GFCI monitoring RC159	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Inverter Current monitoring - RB85	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire

Inverter Current monitoring - RB85	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Inverter Current monitoring + RB87	Open circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Inverter Current monitoring + RB87	Short circuit	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Main CPU, UC20	short circuit CC374	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire
Slave CPU, UC73	short circuit CC374	230V 48A*3	600V 56A	3min	--	230V 0A	600V 0A	Unit shut down and disconnected from grid immediately, no damage, no hazard, no fire

Note:

The errors in the control circuit simulate that the safety is even ensured during single fault,
Details for the error code please refer user manual,

4,3 Voltage fluctuation and flicker				P
Test conditions:	Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100 % power) and flicker as per EN 61000-3-11			
	Starting	Stopping	Running	
Limit	3,3%	3,3%	P _{st} =1,0	P _{lt} =0,65
Test value	*	*	*	*
inverter >16A				
Limit	dc% = 3,3		P _{st} =1,0	P _{lt} =0,65
NAC33K-DT	*		*	*

Note:

*The stationary deviance of dc% is bigger than the dynamic deviance of d_{max} at starting and stopping,
Mains Impedance according EN61000-3-11: **R_{max}=0,4 Ω; jX_{max}=0,25 Ω @50Hz (|Z_{max}| =0,472 Ω)**
Bei Einphasigen Invertern Z_{max} sowie R_n und jx_n angeben **R_n=0,16 Ω; jX_n=0,1 Ω**
Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
Z_{max} = Z_{ref} * 3,3% / d_c(P_n)

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

NAC33K-DT L1 phase

Flicker Mode Uover: ■ ■ ■ ■ I1-3 :500mV YOKOGAWA ◆
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s

Element 1
Volt Range A 300V(230V/50Hz) Element1 Judgement: Pass
Un (U1) 231.052 V Total Judgement: Pass
Freq(U1) 50.002 Hz (Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
Result	Pass	Pass	Pass	Pass	0.07 Pass

Update 3600

2018/11/08 16:33:32

NAC33K-DT L2 phase

Flicker Mode Uover: ■ ■ ■ ■ I1-3 :500mV YOKOGAWA ◆
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s

Element 2
Volt Range A 300V(230V/50Hz) Element2 Judgement: Pass
Un (U2) 231.294 V Total Judgement: Pass
Freq(U2) (Element1,2,3)

	dc[%]	dmax[%]	d(t)[ms]	Pst	P1t
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
5	0.04 Pass	0.31 Pass	0 Pass	0.08 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
Result	Pass	Pass	Pass	Pass	0.07 Pass

Update 3600

2018/11/08 16:34:04

NAC33K-DT L3 phase

Flicker Mode Uover: ■ ■ ■ ■ I1-3 :500mV YOKOGAWA ◆
IEC61000-4-15 Ed2.0 Iover: ■ ■ ■ ■ Flicker:Complete 2:00:00

Count 12/12
Interval 10m00s/10m00s

Element 3
Volt Range A 300V(230V/50Hz) Element3 Judgement: Pass
Un (U3) 231.334 V Total Judgement: Pass
Freq(U3) (Element1,2,3)

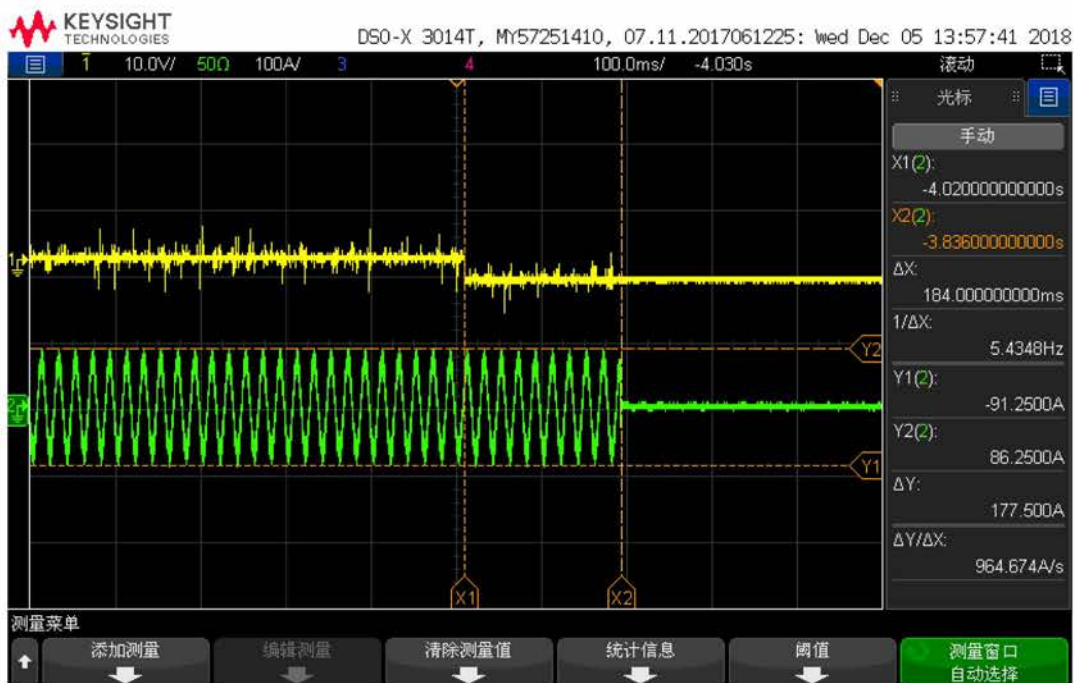
	dc[%]	dmax[%]	d(t)[ms]	Pst	P1t
Limit	3.30	4.00	500 3.30(%)	1.00	0.65 N:12
No. 1	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
2	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
3	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
4	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
5	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
6	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
7	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
8	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
9	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
10	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
11	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
12	0.00 Pass	0.00 Pass	0 Pass	0.07 Pass	
Result	Pass	Pass	Pass	Pass	0.07 Pass

Update 3600

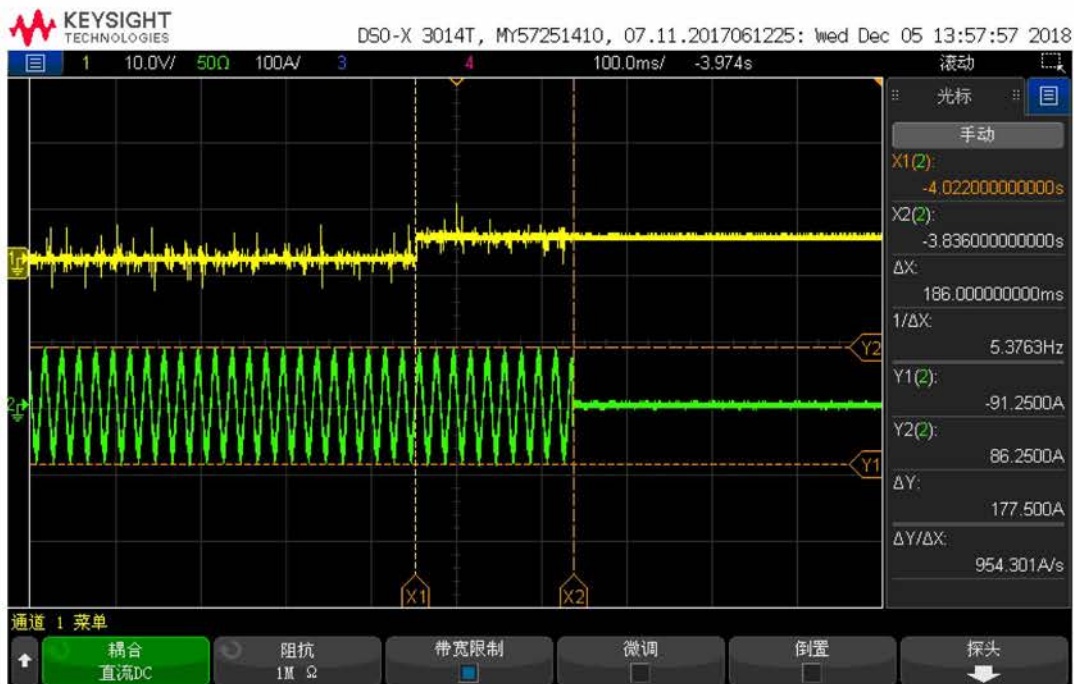
2018/11/08 16:34:35

4,4 Monitoring of Permanent DC-Injection IEC 61727:2004				P
Model: NAC33K-DT				
Test conditions:	$U_N = 230\text{ V}_{AC}$ $U_{input} = 600\text{ V}_{DC}$ Rated Power: 33000 W			
DC Injection (A)	Limits	Trip Time (ms)		
+1,0A	$I_{DC} > 1\text{A}$ than disconnection within 0,2 sec	184	182	182
-1,0A	$I_{DC} > 1\text{A}$ than disconnection within 0,2 sec	186	184	184
Note: A dc-current of 1A is injected, disconnection time of max, 0,2s				

Positive DC-Injection :



Negative DC-Injection :



4,4 Monitoring of Permanent DC-Injection IEC 61727:2004

P

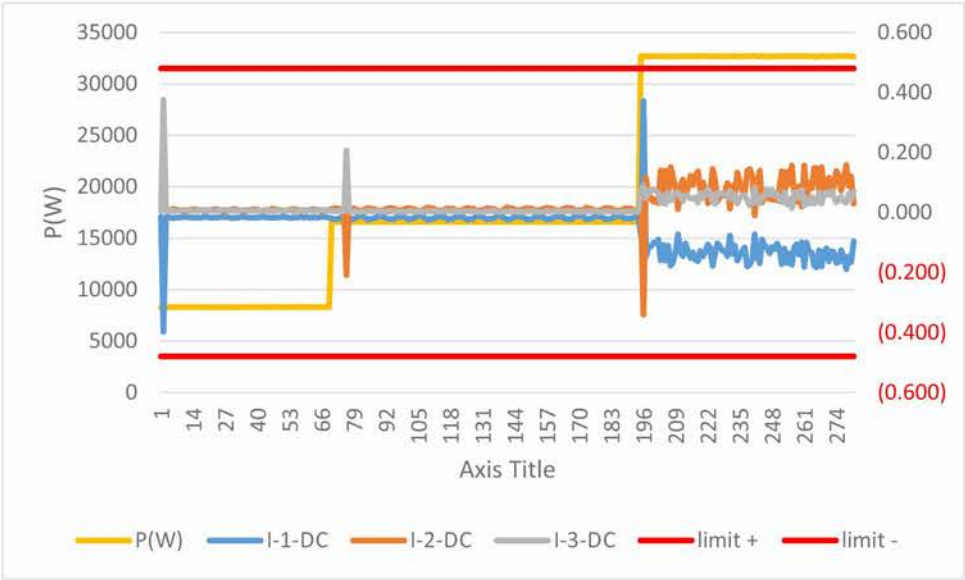
Model:NAC33K-DT

IEC61727 Limit:	1% of Inom (480mA)		
Output power:	25%	50%	100%
mean test value L1 phase :	398	104	372
mean test value L2 phase:	17	209	341
mean test value L3 phase:	376	206	88

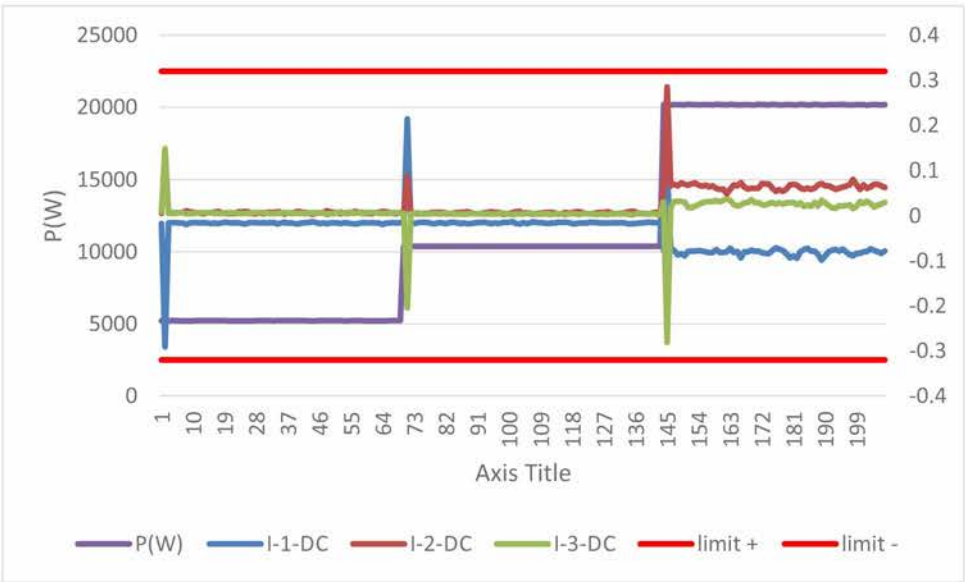
Model: NAC20K-DT

IEC61727 Limit:	1% of Inom (320mA)		
Output power:	25%	50%	100%
mean test value L1 phase:	291	214	107
mean test value L2 phase:	140	88	285
mean test value L3 phase:	128	204	281

NAC33K-DT: Diagram of permanent DC-Injection



NAC20K-DT: Diagram of permanent DC-Injection



**4,6 Harmonic Current Limit Test
IEC 61727:2004**
P
Model: NAC33K-DT L1 phase

Watts(W)	10404,41
VA(VA)	10580,32
Vrms(V)	230,59
Arms(A)	45,12
PF	0,9995
Frequency(Hz)	50,00
THD(%)	1,76

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	45,121	-	L1 phase	--
2nd	0,140	0,310	L1 phase	1%
3rd	0,464	1,028	L1 phase	4%
4th	0,155	0,343	L1 phase	1%
5th	0,402	0,891	L1 phase	4%
6th	0,029	0,064	L1 phase	1%
7th	0,240	0,532	L1 phase	4%
8th	0,046	0,101	L1 phase	1%
9th	0,238	0,527	L1 phase	4%
10th	0,032	0,071	L1 phase	0,5%
11th	0,206	0,457	L1 phase	2%
12th	0,009	0,020	L1 phase	0,5%
13th	0,111	0,247	L1 phase	2%
14th	0,018	0,039	L1 phase	0,5%
15th	0,022	0,050	L1 phase	2%
16th	0,009	0,020	L1 phase	0,5%
17th	0,110	0,243	L1 phase	1,5%
18th	0,009	0,019	L1 phase	0,5%
19th	0,057	0,127	L1 phase	1,5%
20th	0,011	0,025	L1 phase	0,5%
21th	0,037	0,081	L1 phase	1,5%
22th	0,018	0,039	L1 phase	0,5%
23th	0,066	0,147	L1 phase	0,6%
24th	0,009	0,021	L1 phase	0,5%
25th	0,058	0,128	L1 phase	0,6%
26th	0,011	0,024	L1 phase	0,5%
27th	0,010	0,023	L1 phase	0,6%
28th	0,011	0,025	L1 phase	0,5%
29th	0,067	0,149	L1 phase	0,6%
30th	0,005	0,011	L1 phase	0,5%
31th	0,090	0,200	L1 phase	0,6%
32th	0,004	0,009	L1 phase	0,5%
33th	0,012	0,026	L1 phase	0,6%
34th	0,004	0,009	L1 phase	N/A
35th	0,021	0,048	L1 phase	N/A
36th	0,005	0,011	L1 phase	N/A
37th	0,009	0,019	L1 phase	N/A
38th	0,008	0,018	L1 phase	N/A
39th	0,004	0,008	L1 phase	N/A
40th	0,003	0,006	L1 phase	N/A

**4,6 Harmonic Current Limit Test
IEC 61727:2004**
P
Model: NAC33K-DT L2 phase

Watts(W)	10478,65
VA(VA)	10630,32
Vrms(V)	230,59
Arms(A)	45,43
PF	0,9996
Frequency(Hz)	50,00
THD(%)	1,44

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	45,429	-	L2 phase	--
2nd	0,201	0,443	L2 phase	1%
3rd	0,064	0,142	L2 phase	4%
4th	0,157	0,346	L2 phase	1%
5th	0,491	1,082	L2 phase	4%
6th	0,042	0,093	L2 phase	1%
7th	0,192	0,422	L2 phase	4%
8th	0,029	0,065	L2 phase	1%
9th	0,028	0,061	L2 phase	4%
10th	0,028	0,062	L2 phase	0,5%
11th	0,123	0,271	L2 phase	2%
12th	0,009	0,020	L2 phase	0,5%
13th	0,117	0,258	L2 phase	2%
14th	0,021	0,045	L2 phase	0,5%
15th	0,016	0,034	L2 phase	2%
16th	0,006	0,013	L2 phase	0,5%
17th	0,108	0,238	L2 phase	1,5%
18th	0,008	0,017	L2 phase	0,5%
19th	0,044	0,097	L2 phase	1,5%
20th	0,012	0,026	L2 phase	0,5%
21th	0,018	0,040	L2 phase	1,5%
22th	0,016	0,036	L2 phase	0,5%
23th	0,092	0,203	L2 phase	0,6%
24th	0,011	0,025	L2 phase	0,5%
25th	0,057	0,126	L2 phase	0,6%
26th	0,008	0,018	L2 phase	0,5%
27th	0,006	0,013	L2 phase	0,6%
28th	0,010	0,021	L2 phase	0,5%
29th	0,060	0,132	L2 phase	0,6%
30th	0,005	0,011	L2 phase	0,5%
31th	0,106	0,233	L2 phase	0,6%
32th	0,008	0,017	L2 phase	0,5%
33th	0,008	0,017	L2 phase	0,6%
34th	0,008	0,017	L2 phase	N/A
35th	0,022	0,048	L2 phase	N/A
36th	0,005	0,010	L2 phase	N/A
37th	0,007	0,015	L2 phase	N/A
38th	0,006	0,013	L2 phase	N/A
39th	0,004	0,009	L2 phase	N/A
40th	0,003	0,007	L2 phase	N/A

**4,6 Harmonic Current Limit Test
IEC 61727:2004**
P
Model: NAC33K-DT L3 phase

Watts(W)	10468,0
VA(VA)	10680,3
Vrms(V)	230,61
Arms(A)	45,36
PF	0,9995
Frequency(Hz)	50,00
THD(%)	1,89

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	45,357	--	L3 phase	--
2nd	0,166	0,367	L3 phase	1%
3rd	0,487	1,073	L3 phase	4%
4th	0,174	0,383	L3 phase	1%
5th	0,515	1,135	L3 phase	4%
6th	0,028	0,062	L3 phase	1%
7th	0,163	0,360	L3 phase	4%
8th	0,019	0,041	L3 phase	1%
9th	0,266	0,586	L3 phase	4%
10th	0,013	0,029	L3 phase	0,5%
11th	0,143	0,314	L3 phase	2%
12th	0,007	0,015	L3 phase	0,5%
13th	0,091	0,202	L3 phase	2%
14th	0,011	0,023	L3 phase	0,5%
15th	0,032	0,070	L3 phase	2%
16th	0,009	0,020	L3 phase	0,5%
17th	0,123	0,272	L3 phase	1,5%
18th	0,008	0,018	L3 phase	0,5%
19th	0,078	0,172	L3 phase	1,5%
20th	0,005	0,012	L3 phase	0,5%
21th	0,023	0,051	L3 phase	1,5%
22th	0,013	0,028	L3 phase	0,5%
23th	0,089	0,196	L3 phase	0,6%
24th	0,009	0,020	L3 phase	0,5%
25th	0,043	0,096	L3 phase	0,6%
26th	0,014	0,031	L3 phase	0,5%
27th	0,008	0,017	L3 phase	0,6%
28th	0,007	0,016	L3 phase	0,5%
29th	0,064	0,142	L3 phase	0,6%
30th	0,005	0,010	L3 phase	0,5%
31th	0,097	0,213	L3 phase	0,6%
32th	0,005	0,012	L3 phase	0,5%
33th	0,013	0,030	L3 phase	0,6%
34th	0,005	0,010	L3 phase	N/A
35th	0,021	0,047	L3 phase	N/A
36th	0,005	0,011	L3 phase	N/A
37th	0,008	0,018	L3 phase	N/A
38th	0,003	0,007	L3 phase	N/A
39th	0,003	0,006	L3 phase	N/A
40th	0,005	0,010	L3 phase	N/A

**4,6 Harmonic Current Limit Test
IEC 61727:2004**
P
Model: NAC20K-DT L1 phase

Watts(W)	6431,20
VA(VA)	6552,11
Vrms(V)	230,96
Arms(A)	27,84
PF	0,9992
Frequency(Hz)	50,00
THD(%)	2,74

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	27,811	--	L1 phase	--
2nd	0,119	0,429	L1 phase	1%
3rd	0,486	1,747	L1 phase	4%
4th	0,146	0,523	L1 phase	1%
5th	0,425	1,527	L1 phase	4%
6th	0,006	0,023	L1 phase	1%
7th	0,178	0,639	L1 phase	4%
8th	0,010	0,037	L1 phase	1%
9th	0,188	0,675	L1 phase	4%
10th	0,028	0,100	L1 phase	0,5%
11th	0,207	0,745	L1 phase	2%
12th	0,004	0,014	L1 phase	0,5%
13th	0,071	0,254	L1 phase	2%
14th	0,020	0,071	L1 phase	0,5%
15th	0,021	0,074	L1 phase	2%
16th	0,008	0,029	L1 phase	0,5%
17th	0,042	0,152	L1 phase	1,5%
18th	0,003	0,012	L1 phase	0,5%
19th	0,053	0,189	L1 phase	1,5%
20th	0,011	0,039	L1 phase	0,5%
21th	0,032	0,115	L1 phase	1,5%
22th	0,012	0,043	L1 phase	0,5%
23th	0,050	0,180	L1 phase	0,6%
24th	0,003	0,012	L1 phase	0,5%
25th	0,033	0,119	L1 phase	0,6%
26th	0,008	0,030	L1 phase	0,5%
27th	0,002	0,006	L1 phase	0,6%
28th	0,004	0,015	L1 phase	0,5%
29th	0,012	0,042	L1 phase	0,6%
30th	0,003	0,012	L1 phase	0,5%
31th	0,057	0,206	L1 phase	0,6%
32th	0,004	0,014	L1 phase	0,5%
33th	0,008	0,029	L1 phase	0,6%
34th	0,002	0,007	L1 phase	N/A
35th	0,016	0,058	L1 phase	N/A
36th	0,003	0,011	L1 phase	N/A
37th	0,015	0,052	L1 phase	N/A
38th	0,003	0,011	L1 phase	N/A
39th	0,004	0,013	L1 phase	N/A
40th	0,005	0,017	L1 phase	N/A

**4,6 Harmonic Current Limit Test
IEC 61727:2004**
P
Model: NAC20K-DT L2 phase

Watts(W)	6424,20
VA(VA)	6555,43
Vrms(V)	230,81
Arms(A)	27,84
PF	0,9994
Frequency(Hz)	50,00
THD(%)	2,24

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	28,017	--	L2 phase	--
2nd	0,174	0,620	L2 phase	1%
3rd	0,067	0,238	L2 phase	4%
4th	0,140	0,501	L2 phase	1%
5th	0,515	1,837	L2 phase	4%
6th	0,017	0,062	L2 phase	1%
7th	0,162	0,578	L2 phase	4%
8th	0,020	0,070	L2 phase	1%
9th	0,035	0,124	L2 phase	4%
10th	0,036	0,127	L2 phase	0,5%
11th	0,151	0,538	L2 phase	2%
12th	0,004	0,013	L2 phase	0,5%
13th	0,087	0,309	L2 phase	2%
14th	0,016	0,055	L2 phase	0,5%
15th	0,022	0,079	L2 phase	2%
16th	0,013	0,045	L2 phase	0,5%
17th	0,043	0,155	L2 phase	1,5%
18th	0,004	0,014	L2 phase	0,5%
19th	0,026	0,091	L2 phase	1,5%
20th	0,008	0,028	L2 phase	0,5%
21th	0,006	0,022	L2 phase	1,5%
22th	0,012	0,042	L2 phase	0,5%
23th	0,073	0,261	L2 phase	0,6%
24th	0,003	0,011	L2 phase	0,5%
25th	0,045	0,160	L2 phase	0,6%
26th	0,007	0,026	L2 phase	0,5%
27th	0,006	0,022	L2 phase	0,6%
28th	0,005	0,018	L2 phase	0,5%
29th	0,010	0,036	L2 phase	0,6%
30th	0,003	0,011	L2 phase	0,5%
31th	0,065	0,232	L2 phase	0,6%
32th	0,006	0,021	L2 phase	0,5%
33th	0,000	0,001	L2 phase	0,6%
34th	0,004	0,013	L2 phase	N/A
35th	0,011	0,039	L2 phase	N/A
36th	0,002	0,006	L2 phase	N/A
37th	0,011	0,041	L2 phase	N/A
38th	0,004	0,014	L2 phase	N/A
39th	0,004	0,014	L2 phase	N/A
40th	0,007	0,024	L2 phase	N/A

**4,6 Harmonic Current Limit Test
IEC 61727:2004**
P
Model: NAC20K-DT L3 phase

Watts(W)	6458,50
VA(VA)	6656,73
Vrms(V)	231,12
Arms(A)	27,94
PF	0,9992
Frequency(Hz)	50,00
THD(%)	2,83

Harmonics	Current Magnitude [A]	% of Fundamental	Phase	Harmonic Current Limits [%]
1st	27,908	--	L3 phase	--
2nd	0,157	0,563	L3 phase	1%
3rd	0,485	1,737	L3 phase	4%
4th	0,142	0,509	L3 phase	1%
5th	0,459	1,645	L3 phase	4%
6th	0,015	0,053	L3 phase	1%
7th	0,145	0,520	L3 phase	4%
8th	0,013	0,046	L3 phase	1%
9th	0,205	0,733	L3 phase	4%
10th	0,027	0,096	L3 phase	0,5%
11th	0,202	0,723	L3 phase	2%
12th	0,004	0,015	L3 phase	0,5%
13th	0,066	0,237	L3 phase	2%
14th	0,019	0,068	L3 phase	0,5%
15th	0,043	0,152	L3 phase	2%
16th	0,016	0,056	L3 phase	0,5%
17th	0,066	0,236	L3 phase	1,5%
18th	0,008	0,028	L3 phase	0,5%
19th	0,061	0,217	L3 phase	1,5%
20th	0,007	0,025	L3 phase	0,5%
21th	0,024	0,087	L3 phase	1,5%
22th	0,009	0,033	L3 phase	0,5%
23th	0,072	0,259	L3 phase	0,6%
24th	0,004	0,014	L3 phase	0,5%
25th	0,029	0,105	L3 phase	0,6%
26th	0,010	0,037	L3 phase	0,5%
27th	0,005	0,019	L3 phase	0,6%
28th	0,003	0,010	L3 phase	0,5%
29th	0,014	0,050	L3 phase	0,6%
30th	0,003	0,010	L3 phase	0,5%
31th	0,064	0,231	L3 phase	0,6%
32th	0,003	0,011	L3 phase	0,5%
33th	0,003	0,011	L3 phase	0,6%
34th	0,002	0,009	L3 phase	N/A
35th	0,017	0,061	L3 phase	N/A
36th	0,003	0,010	L3 phase	N/A
37th	0,019	0,068	L3 phase	N/A
38th	0,004	0,015	L3 phase	N/A
39th	0,005	0,019	L3 phase	N/A
40th	0,003	0,012	L3 phase	N/A

4,7 Power factor					P
Model	NAC20K-DT				
Output power [kW]	~10%	~20%	~50%	~75%	~100%
Test AC voltage [V]	2,0	4,0	10,0	15,0	20,0
230V	0,9635i	0,9963i	0,9975i	0,9972i	0,0,9992i
Model	NAC25K-DT				
Output power [kW]	~10%	~20%	~50%	~75%	~100%
Test AC voltage [V]	2,5	5,0	12,5	18,75	25,0
230V	0,9828i	0,9970i	0,9973i	0,9991i	0,9994i
Model	NAC30K-DT				
Output power [kW]	~10%	~20%	~50%	~75%	~100%
Test AC voltage [V]	3,0	6,0	15,0	22,5	30,0
230V	0,9899i	0,9973i	0,9972i	0,9993i	0,9995i
Model	NAC33K-DT				
Output power [kW]	~10%	~20%	~50%	~75%	~100%
Test AC voltage [V]	3,3	6,6	16,5	24,75	33,0
230V	0,9913i	0,9974i	0,9973i	0,9993i	0,9995i
Note: The PV system shall have a lagging power factor greater than 0,95 when the output is greater than 50% of the rated inverter output power, The letter "i" is short for "inductive" and indicates inductive power factor, In case of capacitive power factor the letter "c" is used instead,					

5,2,1 Voltage monitoring							P	
IEC 61727: First Level								
Model: NAC33K-DT L1 phase								
	Under Voltage				Over Voltage			
Parameter	Voltage	Time [s]			Voltage	Time [s]		
Limit	195,5V	<= 2,0s			253V	<= 2,0s		
Trip value	196,0V				254,0V			
Trip time(s)	230V to 190,0 V	1,61	1,62	1,62	230V to 258V	1,62	1,62	1,63
Reconnection time (s)	20s<t<300s	67,6			20s<t<300s	67,4		
IEC 61727: Second Level								
	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	115V	<= 100ms			290V*	<= 50ms		
Trip value	116,0V				290,0V			
Trip time(ms)	230V to 110V	57,0	45,0	58,0	230V to 295 V	40,0	43,0	43,0
Reconnection time (s)	20s<t<300s	66,9			20s<t<300s	66,7		
Note: The IEC61727 does not provide any limits of accuracy for the utility voltage and frequency measurement of the PV-system, Therefore the values for tolerances given in EN 50438, Table 2 are used, Tolerances on trip values tabel 2 EN50438: - Voltage: +/- 1% of the nominal voltage - Frequency: +/- 0,5% of the nominal frequency - Clearance time: +/- 10% *The voltage is the biggest vaule that the manufacturer declared,								

Under Voltage First Level



Over voltage First Level



Under Voltage Second Level



Over voltage Second Level



5,2,1 Voltage monitoring								P	
IEC 61727: First Level									
Model: NAC33K-DT L2 phase									
	Under Voltage					Over Voltage			
Parameter	Voltage	Time [s]			Voltage	Time [s]			
Limit	195,5V	<= 2,0s			253V	<= 2,0s			
Trip value	196,0V				254,0V				
Trip time(s)	230V to 190,0V	1,63	1,64	1,64	230V to 258V	1,65	1,64	1,64	
Reconnection time (s)	20s<t<300s	66,5			20s<t<300s	67,2			
IEC 61727: Second Level									
	Under Voltage					Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]			
Limit	115V	<= 100ms			290V*	<= 50ms			
Trip value	116,0V				290,0V				
Trip time(ms)	230V to 110V	59,0	59,0	48,0	230V to 295V	45,0	44,0	44,0	
Reconnection time (s)	20s<t<300s	67,5			20s<t<300s	66,3			
Note:									
The IEC61727 does not provide any limits of accuracy for the utility voltage and frequency measurement of the PV-system, Therefore the values for tolerances given in EN 50438, Table 2 are used,									
Tolerances on trip values tabel 2 EN50438:									
<div>- Voltage: +/- 1% of the nominal voltage</div> <div>- Frequency: +/- 0,5% of the nominal frequency</div> <div>- Clearance time: +/- 10%</div>									
*The voltage is the biggest vaule that the manufacturer declared.									

Under Voltage First Level



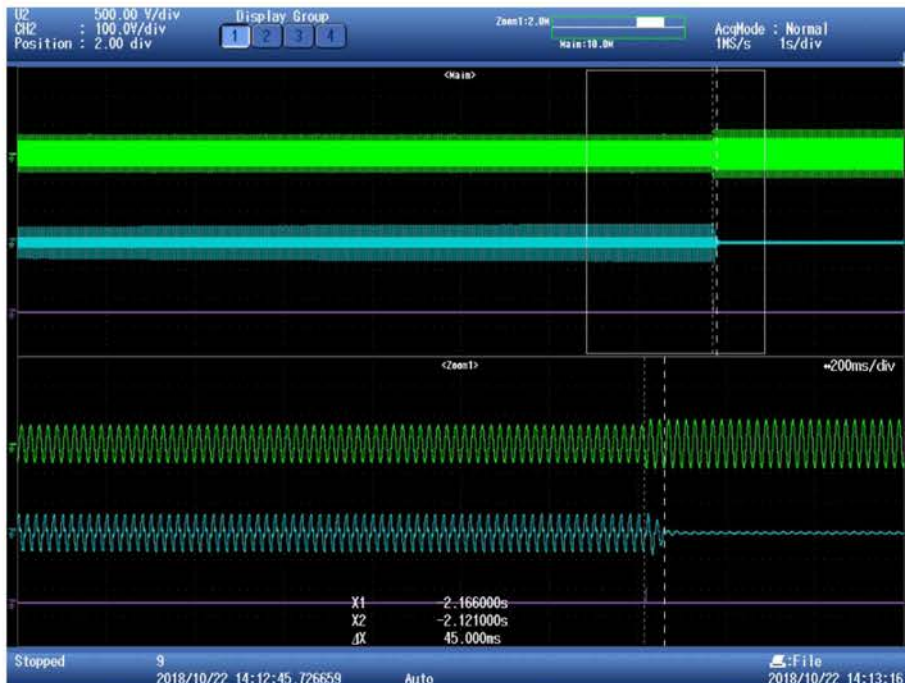
Over voltage First Level



Under Voltage Second Level



Over voltage Second Level



5,2,1 Voltage monitoring							P	
IEC 61727: First Level								
Model: NAC33K-DT L3 phase								
	Under Voltage				Over Voltage			
Parameter	Voltage	Time [s]			Voltage	Time [s]		
Limit	195,5V	<= 2,0s			253V	<= 2,0s		
Trip value	196,0V				254,0V			
Trip time(s)	230V to 190,0V	1,64	1,635	1,63	230V to 258V	1,64	1,62	1,64
Reconnection time (s)	20s<t<300s	67,3			20s<t<300s	65,3		
IEC 61727: Second Level								
	Under Voltage				Over Voltage			
Parameter	Voltage	Time [ms]			Voltage	Time [ms]		
Limit	115V	<= 100ms			290V*	<= 50ms		
Trip value	116,0V				290,0V			
Trip time(ms)	230V to 110V	40,0	55,0	64,0	230V to 278V	41,0	30,0	44,0
Reconnection time (s)	20s<t<300s	66,4			20s<t<300s	67,4		
Note: The IEC61727 does not provide any limits of accuracy for the utility voltage and frequency measurement of the PV-system, Therefore the values for tolerances given in EN 50438, Table 2 are used, Tolerances on trip values tabel 2 EN50438: - Voltage: +/- 1% of the nominal voltage - Frequency: +/- 0,5% of the nominal frequency - Clearance time: +/- 10% *The voltage is the biggest vaule that the manufacturer declared,								

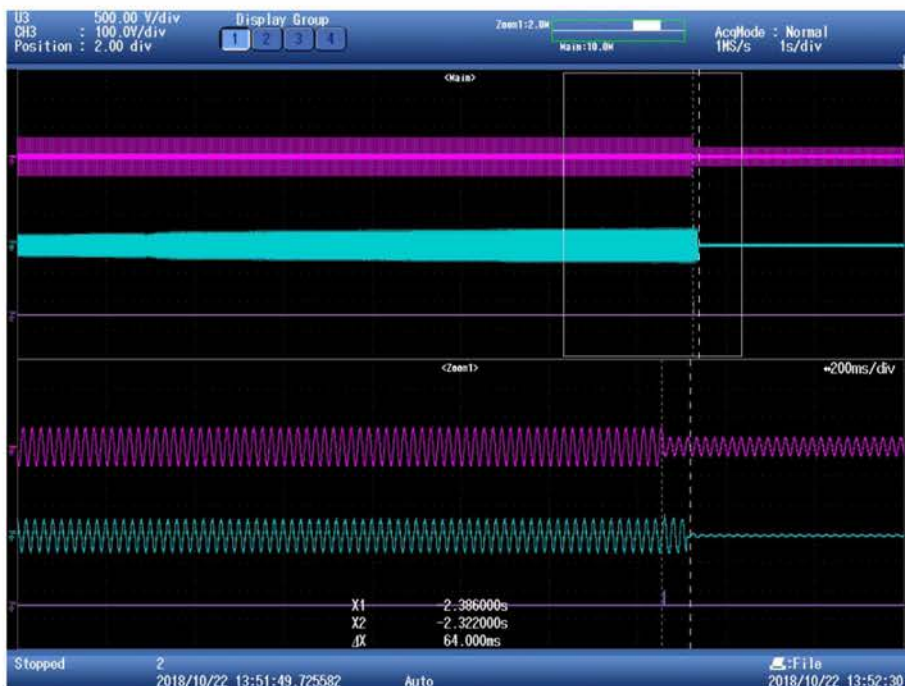
Under Voltage First Level



Over voltage First Level



Under Voltage Second Level



5,2,2 Frequency monitoring							P	
IEC 61727								
Model: NAC33K-DT								
	Under frequency				Over frequency			
Parameter	Frequency	Time [ms]			Frequency	Time [ms]		
Output Voltage		85%U _N	U _N	110%U _N		85%U _N	U _N	110%U _N
Limit	49,00Hz	<= 200ms			51,00Hz	<= 200ms		
Trip value		49,0	49,0	49,0		51,00	51,00	51,00
Trip time(ms)	49,5Hz to 48,5Hz	150	146	160	50,5Hz to 51,5Hz	143	142	150
Reconnection time(s)	20s<t<300s	66,5			20s<t<300s	66,4		
Note: It was measured at a continuous change of frequency of 1 Hz / s at lower, nominal and upper U _N and arbitrary output power. The trip value was determined manually by reducing the frequency in 10 mHz steps. When the trip value is known (e.g. 49,0 Hz), the ac-source is programmed to run from e.g. 49,50 Hz to 48,50 Hz with 1 Hz / s. The disconnection time is calculated by the measured time minus the 500 ms from 49,5 Hz to 49,00 Hz. The IEC61727 does not provide any limits of accuracy for the utility voltage and frequency measurement of the PV-system, Therefore the values for tolerances given in EN 50438, Table 2 are used, Tolerances on trip values tabel 2 EN50438: - Voltage: +/- 1% of the nominal voltage - Frequency: +/- 0,5% of the nominal frequency - Clearance time: +/- 10%								

Under Frequency:



Over Frequency:



Annex 1

EMC Test Report

(The whole EMC test report was stored in internal of BV LCIE CHINA)



BV LCIE CHINA
(Ningbo Branch)
Number

N° 1899AB09AARE00119

LCIE

ATTESTATION of conformity with European Directives

Product : PV inverter (Grid-tied photovoltaic inverter)
Reference : NAC20K-DT, NAC25K-DT, NAC30K-DT, NAC33K-DT
Trade mark : --

Technical characteristics : Refer to the next page

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

Electromagnetic Compatibility Directive 2014/30/EU

Standards	Report number	Report date
EN 61000-6-3:2007+A1:2011 EN 61000-6-2:2005 EN 61000-3-2:2014 EN 61000-3-3:2013	ABRE-18AU2503VTNBPB	Dec 06, 2018

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

Ningbo (P.R. China), Dec 06, 2018



This document shall not be reproduced, except in full, without the written approval of BV LCIE China (Ningbo Branch).
Information given in this document, are related to the tested specimen of the described electrical sample.

LCIE CHINA (Ningbo Branch)
必维欧亚电气技术服务(上海)有限公司
宁波分公司
Version 1.0/2018.06.10

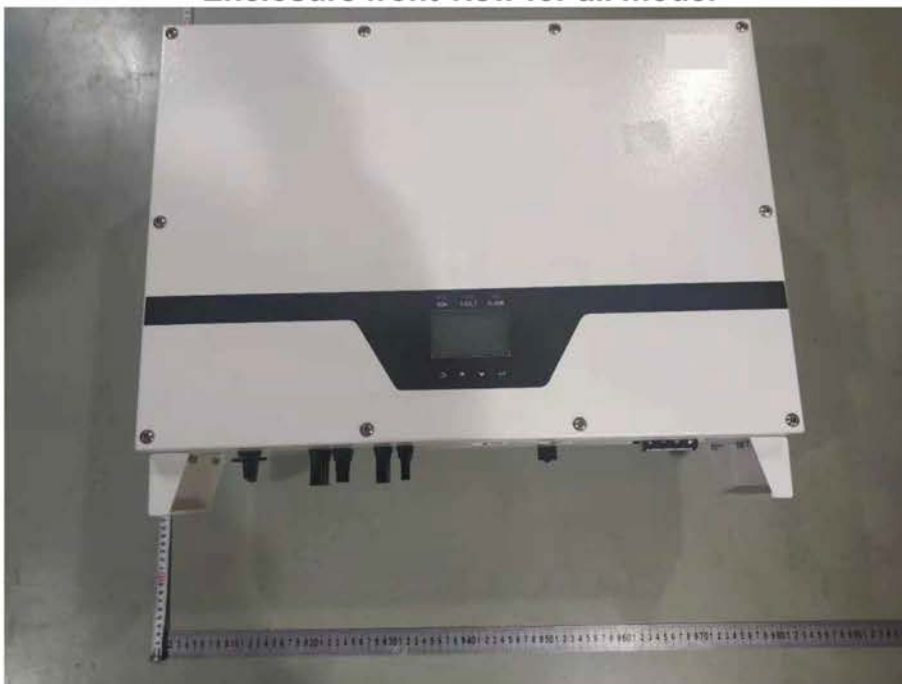
Building B, No.66 Qingyi Road, Hi-Tech Zone, Ningbo,
Zhengjiang, China

Tel: +86 574 8709 1078
Fax: +86 574 87907993
Email: contact@cn.bureauveritas.com

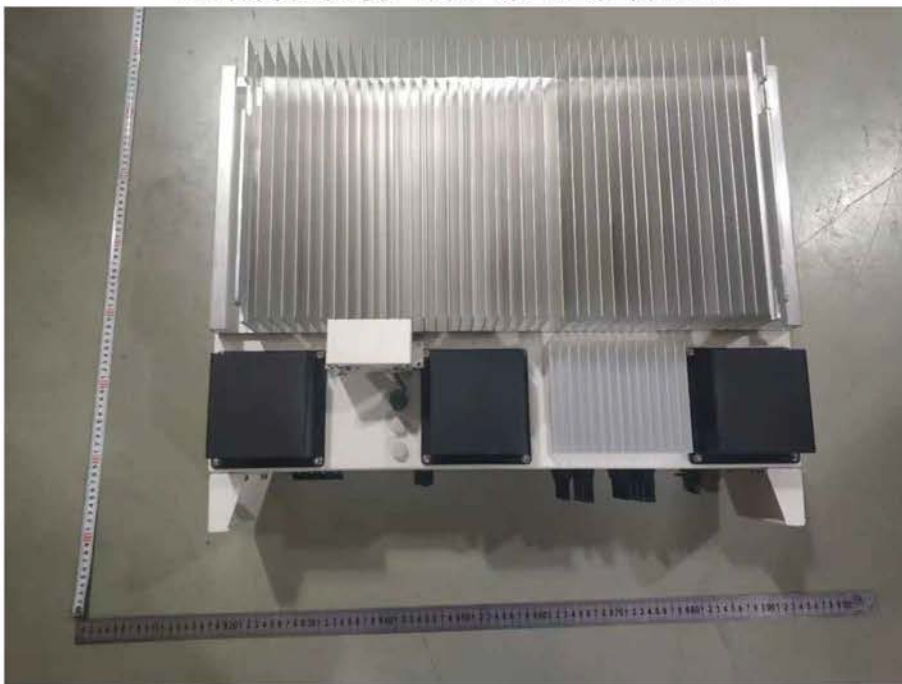
Annex 2

Pictures of the unit

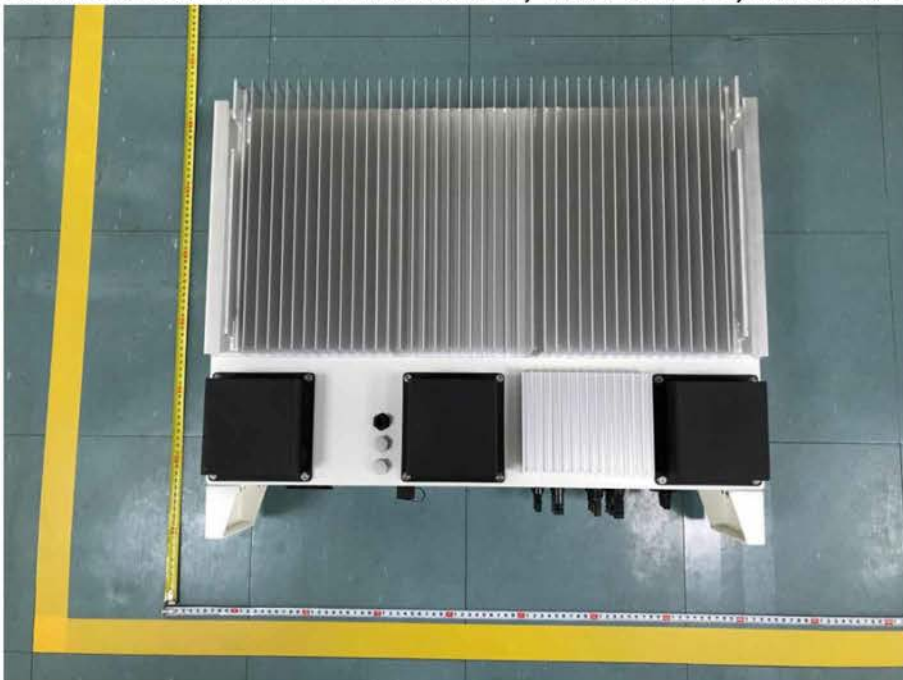
Enclosure front view for all model



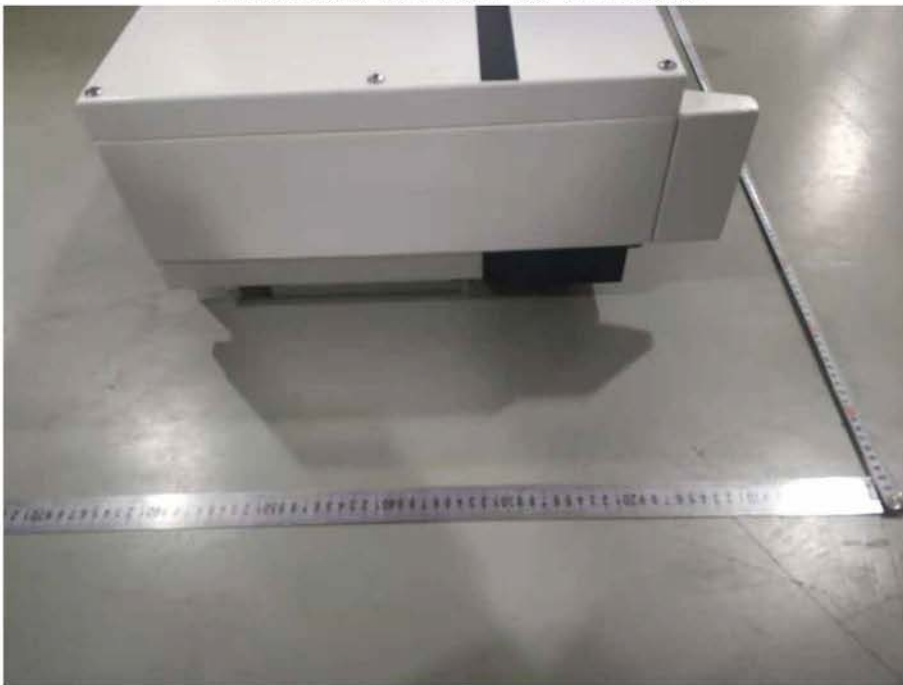
Enclosure rear view for NAC-33K-DT



Enclosure rear view for NAC30K-DT, NAC25K-DT , NAC20K-DT



Enclosure left view for all model



Enclosure right view for all model



Enclosure top view for all model



Enclosure bottom view for model NAC33K-DT, NAC30K-DT



Enclosure bottom view for model NAC25K-DT



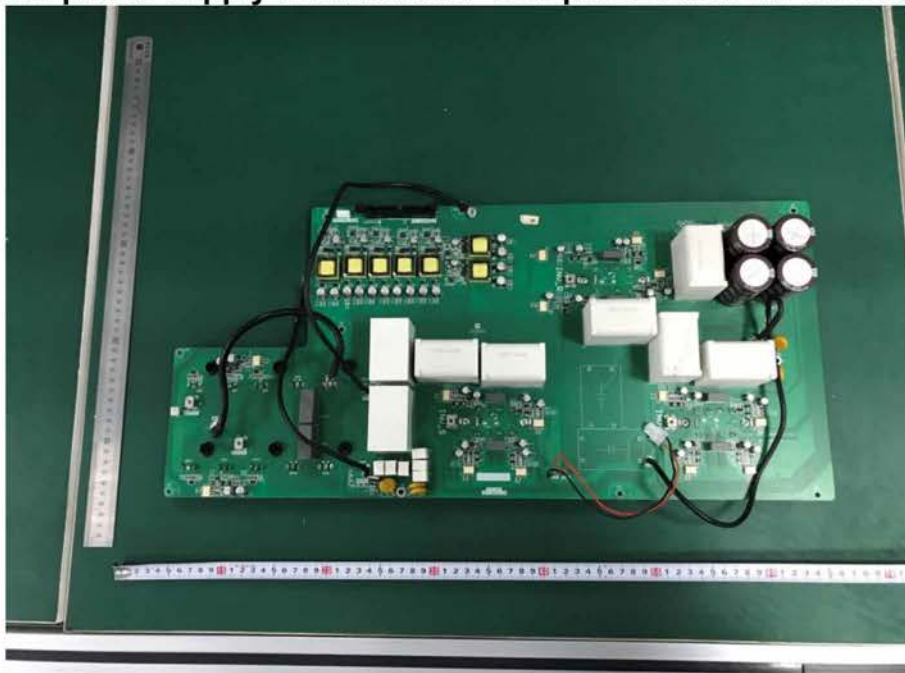
Enclosure bottom view for model NAC20K-DT



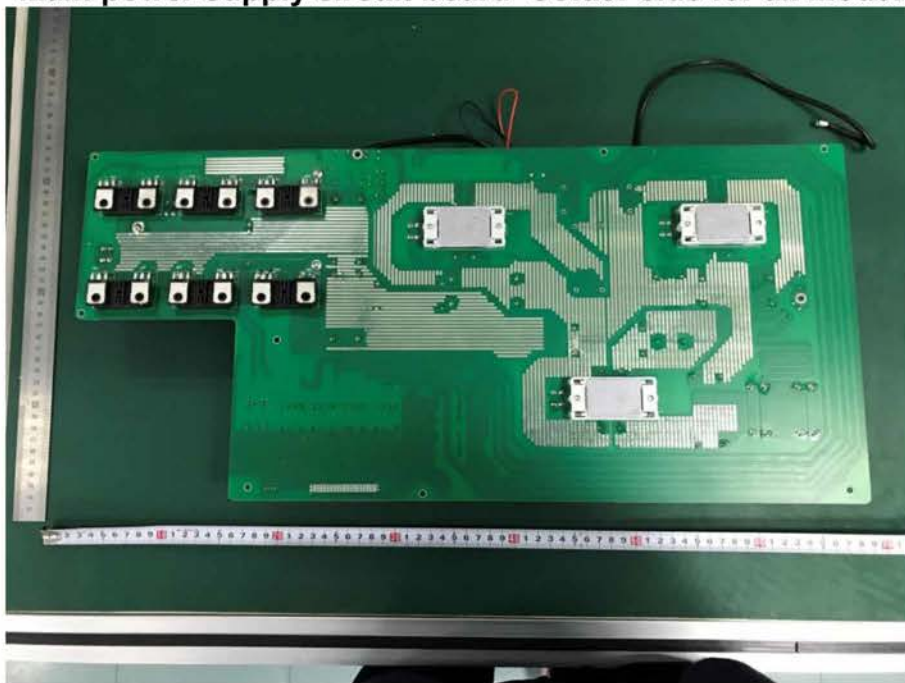
Enclosure internal view for all model



Main power supply circuit board- Component side for all model



Main power supply circuit board- Solder side for all model



Control board- Component side for all model



Control board- Solder side for all model



LCD board- Component side for all model



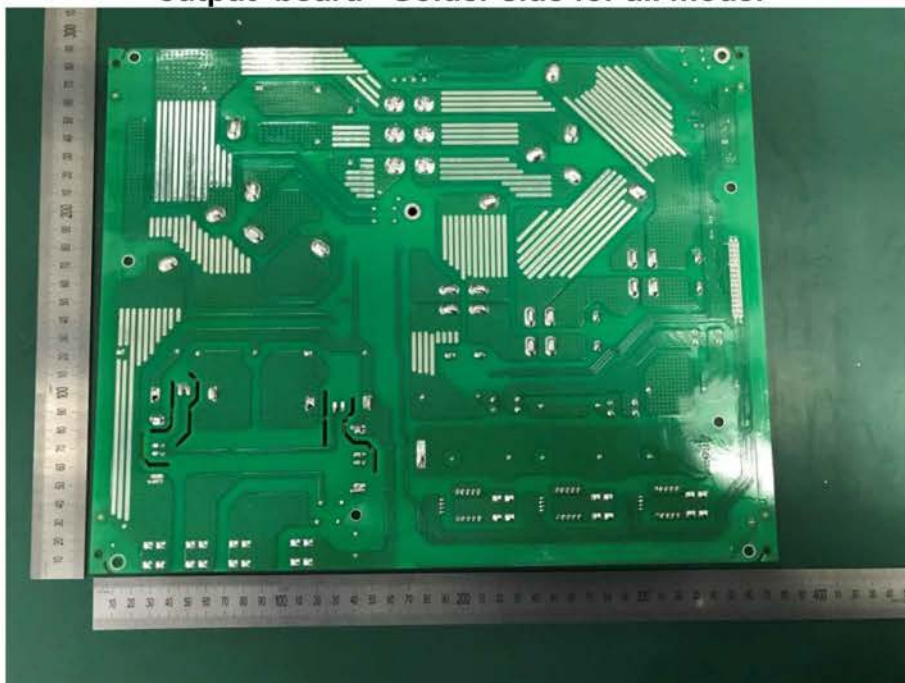
LCD board- Solder side for all model



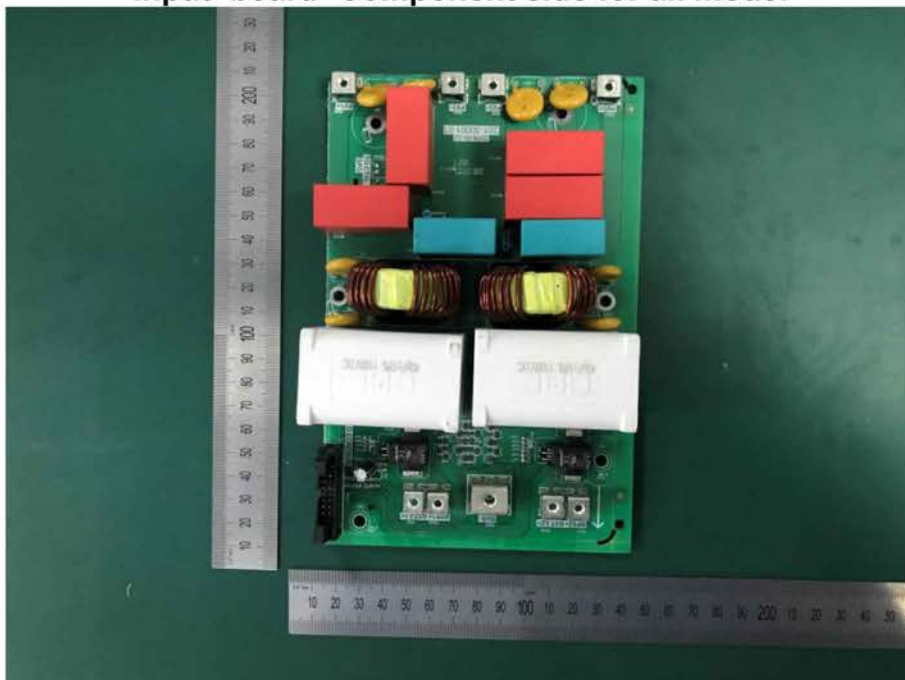
output board- Component side for all model



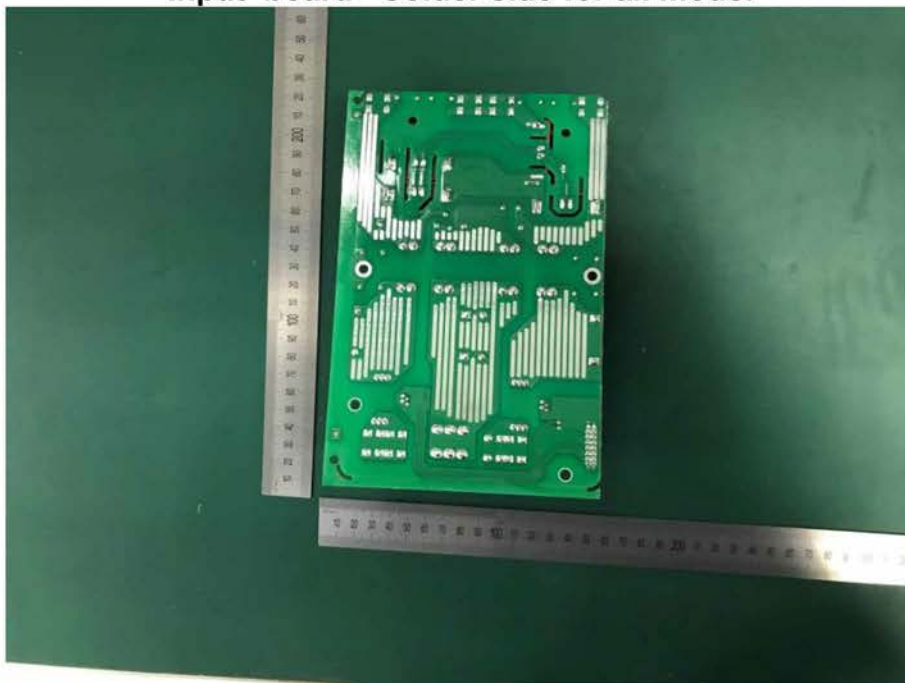
output board - Solder side for all model



input board- Component side for all model



input board - Solder side for all model



communication board- Component side for all model



communication board - Solder side for all model



Earthing connection view for all model



Annex 3

Test Equipment list

No,	Equipment	Internal No,	Type/characteristics	Manufacturer	Last Calibration	Due Data
1	Oscilloscope	A4089024SH	P4034B	Tektronix	26/Jul/18	25/Jul/19
2	Oscilloscope	A4089008SH	DPO3014	Tektronix	05/Feb/18	04/Feb/19
3	Oscilloscope	A4089036SH	DL850	YOKOGAWA	29/Aug/18	28/Aug/19
4	High Voltage probe	A4089026SH	P5200A	Tektronix	05/Feb/18	04/Feb/19
5	Voltage probe	A4089004SH	P2220	Tektronix	10/Oct/18	09/Oct/19
6	Current probe	A4089009SH	P6139B	Tektronix	05/Feb/18	04/Feb/19
7	Current probe	A4089013SH	A622	Tektronix	05/Feb/18	04/Feb/19
8	Current probe	A4089037SH	960 30	YOKOGAWA	10/Oct/18	09/Oct/19
9	Current probe	A4089038SH	960 30	YOKOGAWA	10/Oct/18	09/Oct/19
10	Current probe	A4089039SH	960 30	YOKOGAWA	10/Oct/18	09/Oct/19
11	Current probe	A4089017SH	TCP0150	Tektronix	26/Jul/18	25/Jul/19
12	AC power supply	A7040066SH	AFC-31010T	APC	08/Aug/18	31/Jul/20
13	AC power supply	A7040071SH	29/May/68	Chroma	22/Feb/18	21/Feb/20
14	AC power supply	A7040057SH	29/May/68	Chroma	19/Jul/17	18/Jul/19
15	AC power supply	A7040077SH	MX-30	AMETEK	-	-
16	Programmable DC source	A7040058SH	62150H-1000S	Chroma	-	-
17	Programmable DC source	A7040059SH	62150H-1000S	Chroma	-	-
18	Programmable DC source	A7040069SH	62150H-1000S	Chroma	-	-
19	Programmable DC source	A7040074SH	62150H-1000S	Chroma	-	-
20	Programmable DC source	A7040075SH	62150H-1000S	Chroma	-	-

21	Programmable DC source	A7040076SH	62150H-1000S	Chroma	-	-
22	Programmable DC source	A7040070SH	62150H-1000S	Chroma	-	-
23	Power Analyzer	A1240096SH	WT3000	YOKOGAWA	31/Oct/18	30/Oct/19
24	Power Analyzer	A1240097SH	WT3000	YOKOGAWA	09/May/18	08/May/19
25	Power Analyzer	A1240103SH	LMG500	ZES ZIMMER	26/Jul/18	25/Jul/19
26	Power Analyzer	A1240101SH	WT3000	YOKOGAWA	26/Jul/18	25/Jul/19
27	Anti-isolating test system	A7150074SH	ACTL-380SH	qunling	-	-
28	Load cabinet	A7150083SH	WSTF-LDJ60K/300	shanghai wen shun	-	-
29	Load cabinet	A7150084SH	WSTF-LDJ45K/0385	shanghai wen shun	-	-
30	Load cabinet	A7150085SH	WSTF-LDJ45K/0385	shanghai wen shun	-	-
31	Load cabinet	A7150075SH	WSTF-RC25k/0,3D 0,001kVA-25kVA	shanghai wen shun	-	-
32	Temperature recorder	A740037SH	G820	GRAPHIEC	10/Oct/18	09/Oct/19
33	Load cabinet(for flick)	A7150090SH	200Ω , 250V;1200W	shanghai wen shun	-	-
34	Variable resistor	A7150076SH	BX8-67	LingOu	-	-