

TEST REPORT

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

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Testing laboratory name:	Bureau Veritas LCIE China Company Limited
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Applicant's name:	SolaX Power Network Technology (Zhe jiang) Co., Ltd.
Address:	No. 288 Shizhu Road, Tonglu Economic Development Zone, Dongxing District 311500, Tonglu City, Zhejiang Province, People's Republic of China
Test specification	
Standard:	IEC 62116:2014
Certificate:	Certificate of compliance
Test report form number	IEC 62116
Master TRF:	Bureau Veritas Consumer Products Services Germany GmbH
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Test item description	Grid-tied photovoltaic inverter
Trademark:	SOLAX
Model / Type:	X1-Hybrid-3.0-N-E, X1-Hybrid-3.0-D-E, X1-Hybrid-3.7-N-E, X1-Hybrid- 3.7-D-E, X1-Hybrid-4.6-N-E, X1-Hybrid-4.6-D-E, X1-Hybrid-5.0-N-E, X1-Hybrid-5.0-D-E, X1-Fit-3.7E,X1-Fit-5.0E

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Model / Type:	X1-Hybrid- 3.0-N-E, X1-Hybrid- 3.0-D-E	X1-Hybrid- 3.7-N-E, X1-Hybrid- 3.7-D-E	X1-Hybrid- 4.6-N-E, X1-Hybrid- 4.6-D-E	X1-Hybrid- 5.0-N-E, X1- Hybrid-5.0-D- E
MPP voltage range [V]:		125-55	0V d.c.	
Max. DC voltage [V]:		600V	′ d.c.	
Max. DC current [A]		10/10	A d.c.	
Nominal AC voltage [V]:		230V a.c.	50/60Hz	
Max. Output AC current [A]:	14,4A a.c.	16A a.c.	21A a.c.	21,7A a.c.
Nomina AC apparent power [VA]:	3000VA	3680VA	4600VA	4999VA
Battery Voltage Operation Range:		85-400)V d.c.	
Max Charge and Discharge Current:	20A			
Model / Type:	X1-Fit-3.7E	X1-Fit-5.0E		
Nominal AC voltage [V]:	230V a.c.			
Nominal AC Frequency [Hz]:	50/60Hz			
Max. AC output/intput current [A]:	16 A a.c.	21,7A a.c.		
Nomina AC apparent power [VA]:	3680VA	4999VA		
Battery Voltage Operation Range:	85-4	00V	·	
Max Charge and Discharge Current :	20	A		



Bureau Veritas LCIE China Company Limited			
Building 4, No. 518, Xinzhuan Road, Caohejing Songjiang High- Park, Shanghai, P.R.China (201612)			
Tony Huang Test engineer	Joynung		
Harvey Wang Project Manager			
SolaX Power Network Te	echnology (Zhe jiang) Co., Ltd,		
	nglu Economic Development Zone, Tonglu City, Zhejiang Province, People's		
	Building 4, No. 518, Xinzh Park, Shanghai, P.R.Chin Tony Huang Test engineer Harvey Wang Project Manager SolaX Power Network Te No, 288 Shizhu Road, Tor Dongxing District 311500,		

Date	Internal reference	Modification / Change / Status	Revision
2019-05-27	Tony Huang	Initial report was written	0
Supplementary	information:		



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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]	24kg for X1-Hybrid-3.0-N-E, X1-Hybrid-3.0-D-E, X1-Hybrid-3.7-N-E, X1-Hybrid-3.7-D-E, X1-Hybrid-4.6-N-E, X1-Hybrid-4.6-D-E, X1-Hybrid 5.0-N-E, X1-Hybrid-5.0-D-E 23kg for X1-Fit-3.7E,X1-Fit-5.0E
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:	2018-10-30
Date(s) of performance test:	2018-11-14 to 2019-05-16
General remarks:	
The test result presented in this report in This report must not be reproduced, in laboratory.	relate only to the object(s) tested. part or in full, without the written approval of the issuing testing
"(see Annex #)" refers to additional info "(see appended table)" refers to a table	
Throughout this report a comma is used	d as the decimal separator.
This Test Report consists of the follo	owing documents:
•	-

3. Annex No. 2 - Test equipment list



Copy of marking plate:

Model: X1-Hybrid-3.0-D-E	SOLAX Model: X1-
DC INPUT	DC INPUT
Max.DC Voltage	600V Max.DC Volt
MPP Voltage Range	125-550V MPP Voltage
Max.DC Current (Input A/Input B)	10A/10A Max.DC Curr
Isc PV(Input A/Input B)	14A/14A Isc PV(Input
Max.DC Power (@coso=1)	4000W Max.DC Pow
AC OUTPUT & AC INPUT	AC OUTPUT
Nominal AC Voltage, Frequency	230V~,50/60Hz Nominal AC
Nominal AC Apparent Power (@cosp	=1) 3000VA Nominal AC
Max. AC Output/Input Current	14.4A/14.4A Max. AC Out
Power Factor at Rated Power	1 Power Facto
Power Factor Range 0.8 Le	eading - 0.8 Lagging Power Facto
OTHERS	OTHERS
EPS Nominal Voltage, Frequency	230V~,50/60Hz EPS Nominal
EPS Nominal Apparent Power	4000VA EPS Nominal
EPS Rated Current	17.4A EPS Rated Ci
Battery Type	Lithium Battery Type
Battery Voltage Operation Range	85-400V Battery Volta
Max.Charge and discharge Current	20A Max.Charge
Operating Ambient Temperature Ran	
Ingress Protection	IP65 Ingress Prote
Inverter Topology	non-isolated Inverter Topo
Protective Class	I Protective CI
Over Voltage Category	III (MAINS),II (DC) Over Voltage
Grid Monitoring AS4777/ VDE-A EN50438/ VDE	R-N 4105/ CEI 0-21 Grid Monitor
DRMO DRM1 DRM2 DRM3 DRM4 DRM1	S DRM6 DRM7 DRM8 DRM0 DRM1 I
Inverter SN:	Inverter SN:
Register SN:	Register SN:
C€ (◎) (◎) (▲) ▲ (◎) (◎) (▲)	
SolaX Power Network Technology(Zhe J ADD:No.288 Shizhu Road,Tonglu Econom Dongxing District,Tonglu City, Zhejia TEL: +86 571 5626 0011 E-mail: infe	hic Development Zone, ADD:No.288 S

DC INPUT	
Max.DC Voltage	600V ===
MPP Voltage Range	125-550V ====
Max.DC Current (Input A/Input B)	10A/10A
lsc PV(Input A/Input B)	14A/14A
Max.DC Power (@cosφ=1)	4000W
AC OUTPUT & AC INPUT	
Nominal AC Voltage, Frequency	230V~,50/60Hz
Nominal AC Apparent Power (@cos	p=1) 3000VA
Max, AC Output/Input Current	14.4A/14.4A
Power Factor at Rated Power	1
Power Factor Range 0.8	Leading- 0.8 Lagging
OTHERS	
EPS Nominal Voltage, Frequency	230V~,50/60Hz
EPS Nominal Apparent Power	4000VA
EPS Rated Current	17.4A
Battery Type	Lithium
Battery Voltage Operation Range	85-400V
Max.Charge and discharge Current	20A
Operating Ambient Temperature Ra	nge -2060°C
Ingress Protection	IP65
Inverter Topology	non-isolated
Protective Class	I
Over Voltage Category	III (MAINS), II (DC
	AR-N 4105/ CEI 0-2: E0126-1-1/ G59
	15 DRM6 DRM7 DRM8



GRID-CONNECTED PHOTOVOLTAIC INVERTER		X
Model: X1-Hybrid-3.7-D-E	s	
DC INPUT		
Max.DC Voltage	600V	
MPP Voltage Range	125-550V	
Max.DC Current (Input A/Input B)	10	A/10A
lsc PV(Input A/Input B)	14	A/14A
Max.DC Power (@cosφ=1)	5	000W
AC OUTPUT & AC INPUT		
Nominal AC Voltage, Frequency	230V~,50/	60Hz
Nominal AC Apparent Power (@coso		80VA
Max. AC Output/Input Current	16	A/16A
Power Factor at Rated Power		1
Power Factor Range 0.8 Le	eading-0.8 L	agging
OTHERS		
EPS Nominal Voltage, Frequency	230V~,50/	60Hz
EPS Nominal Apparent Power	40	AV000
EPS Rated Current		17.4A
Battery Type	Li	thium
Battery Voltage Operation Range	85-400	V
Max.Charge and discharge Current		20A
Operating Ambient Temperature Ran	ge -20	60°C
Ingress Protection		IP65
Inverter Topology	non-is	olated
Protective Class		1
Over Voltage Category	III (MAINS)	,II (DC)
Grid Monitoring AS4777/ VDE-A EN50438/ VDE	0126-1-1/G	9
DRM0 DRM1 DRM2 DRM3 DRM4 DRM5		7 DRM8
Inverter SN:		
Register SN:		
(€ 🎯 🗠 🛆 Ž 🚇 ⊗ 💩		
SolaX Power Network Technology(Zhe. ADD:No.288 Shizhu Road,Tonglu Econor Dengxing District,Tonglu City, Zhejii TEL: +86 571 5626 0011 E-mail: Infe	nic Developm	ent Zone China.
www.solaxpower.com	MADE II 61	

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PHOTOVOLTAIC INVERTER Model: X1-Hybrid-3.7-N-E		IOTOVOLTAIC INVERTER odel: X1-Hybrid-4.6-D-E	SOLAX	PHOTOVOLTAIC INVERTER Model: X1-Hybrid-4.6-N-E	SOLAX
DC INPUT	D	C INPUT		DC INPUT	
Max.DC Voltage	500V === M	ax.DC Voltage	600V ====	Max.DC Voltage	600V ====
MPP Voltage Range 125-	550V === M	PP Voltage Range	125-550V ====	MPP Voltage Range	125-550V ====
Max.DC Current (Input A/Input B)		ax.DC Current (Input A/Input B)	10A/10A	Max.DC Current (Input A/Input B)	10A/10A
Isc PV(Input A/Input B)	14A/14A Is	c PV(Input A/Input B)	14A/14A	Isc PV(Input A/Input B)	14A/14A
Max.DC Power (@cosq=1)	5000W M	ax.DC Power (@cosq=1)	6000W	Max.DC Power (@cosq=1)	6000W
AC OUTPUT & AC INPUT	A	C OUTPUT & AC INPUT		AC OUTPUT & AC INPUT	
Nominal AC Voltage, Frequency 230	V~,50/60Hz N	ominal AC Voltage, Frequency	230V~,50/60Hz	Nominal AC Voltage, Frequency	230V~,50/60Hz
Nominal AC Apparent Power (@cosφ=1)	3680VA N	ominal AC Apparent Power (@cosø=	1) 4600VA	Nominal AC Apparent Power (@coso=	=1) 4600VA
Max, AC Output/Input Current	16A/16A M	ax, AC Output/Input Current	21A/21A	Max. AC Output/Input Current	21A/21A
Power Factor at Rated Power		ower Factor at Rated Power	1	Power Factor at Rated Power	1
Power Factor Range 0.8 Leading-	0.8 Lagging Po	ower Factor Range 0.8 Lea	ading- 0.8 Lagging	Power Factor Range 0.8 Lea	ading- 0.8 Lagging
OTHERS	0	THERS		OTHERS	
EPS Nominal Voltage, Frequency 230	V~,50/60Hz EI	S Nominal Voltage, Frequency	230V~,50/60Hz	EPS Nominal Voltage, Frequency	230V~,50/60Hz
EPS Nominal Apparent Power	4000VA E	PS Nominal Apparent Power	5000VA	EPS Nominal Apparent Power	5000VA
EPS Rated Current	17.4A EI	PS Rated Current	21.7A	EPS Rated Current	21.7A
Battery Type	Lithium Ba	attery Type	Lithium	Battery Type	Lithium
Battery Voltage Operation Range 8	5-400V==== Ba	attery Voltage Operation Range	85-400V	Battery Voltage Operation Range	85-400V
Max.Charge and discharge Current	20A M	ax.Charge and discharge Current	20A	Max.Charge and discharge Current	20A
Operating Ambient Temperature Range	-2060°C O	perating Ambient Temperature Rang	e -2060°C	Operating Ambient Temperature Rang	je -2060°C
Ingress Protection	IP65 In	gress Protection	IP65	Ingress Protection	IP65
Inverter Topology	non-isolated In	verter Topology	non-isolated	Inverter Topology	non-isolated
Protective Class	I Pr	otective Class	1	Protective Class	1
Over Voltage Category III (M	AAINS),II (DC)	ver Voltage Category	III (MAINS),II (DC)	Over Voltage Category	III (MAINS),II (DC)
Grid Monitoring AS4777/ VDE-AR-N 41 EN50438/ VDE0126-1		rid Monitoring AS4777/ VDE-AF EN50438/ VDE0	R-N 4105/ CEI 0-21	Grid Monitoring AS4777/ VDE-AF EN50438/ VDE0	R-N 4105/ CEI 0-21 0126-1-1/ G59
DRM0 DRM1 DRM2 DRM3 DRM4 DRM5 DRM6		RMO DRM1 DRM2 DRM3 DRM4 DRM5	DRM6 DRM7 DRM8	DRM0 DRM1 DRM2 DRM3 DRM4 DRM5	
Inverter SN:	Inv	erter :		Inverter SN:	
Register SN:	Re SN	gister :		Register SN:	
CCC C C C C C C C C C C C C C C C C C	elopment Zone, Al vince, China.	CC W W W W W W W W W W W W W W W W W W	ic Development Zone, ng Province, China.	CCC I I I I I I I I I I I I I I I I I I	nic Development Zone ng Province, China.
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PHOTOVOLTAIC INVERTER Model: X1-Hybrid-5.0-D-E	PHOTOVOLTAIC INVERTER Model: X1-Hybrid-5.0-N-E	Model: X1-Fit-3.7E
DC INPUT	DC INPUT	AC OUTBUT 5 AC INDUT
Max.DC Voltage 600V ===	Max.DC Voltage 600V ===	AC OUTPUT & AC INPUT
MPP Voltage Range 125-550V	MPP Voltage Range 125-550V	Nominal AC Voltage, Frequency 230V~,50/60
Max.DC Current (Input A/Input B) 10A/10A	Max.DC Current (Input A/Input B) 10A/10A	Nominal AC Apparent Power (@cos@=1) 3680
lsc PV(input A/input B) 14A/14A	Isc PV(Input A/Input B) 14A/14A	Max. AC Output/Input Current 16A/1
Max.DC Power (@cosq=1) 6000W	Max.DC Power (@cosq=1) 6000W	Power Factor at Rated Power
AC OUTPUT & AC INPUT	AC OUTPUT & AC INPUT	Power Factor Range 0.8 Leading - 0.8 Lago
Nominal AC Voltage, Frequency 230V~,50/60Hz	Nominal AC Voltage, Frequency 230V~,50/60Hz	EPS OUTPUT
Nominal AC Apparent Power (@cos@=1) 4999VA	Nominal AC Apparent Power (@cosφ=1) 4999VA	
Nominal AC Apparent Power for VDE 4105 (@cosp=1) 4600VA	Nominal AC Apparent Power for VDE 4105 (@cosp=1) 4600VA	
Max. AC Output/Input Current 21.7A/21.7A	Max. AC Output/Input Current 21.7A/21.7A	EPS Nominal Apparent Power 4000
Power Factor at Rated Power 1	Power Factor at Rated Power 1	EPS Rated Current 17.
Power Factor Range 0.8 Leading- 0.8 Lagging	Power Factor Range 0.8 Leading- 0.8 Lagging	BATTERY
OTHERS	OTHERS	Battery Type Lithi
EPS Nominal Voltage, Frequency 230V~,50/60Hz	EPS Nominal Voltage, Frequency 230V~,50/60Hz	Battery Voltage Operation Range 85-400V=
EPS Nominal Apparent Power 5000VA	EPS Nominal Apparent Power 5000VA	
EPS Rated Current 21.7A	EPS Rated Current 21.7A	Max.Charge and discharge Current 2
Battery Type Lithium	Battery Type Lithium	OTHERS
Battery Voltage Operation Range 85-400V	Battery Voltage Operation Range 85-400V	Operating Ambient Temperature Range -2060
Max.Charge and discharge Current 20A	Max.Charge and discharge Current 20A	Ingress Protection If
Operating Ambient Temperature Range -2060°C	Operating Ambient Temperature Range -2060°C	Inverter Topology non-isola
Ingress Protection IP65	Ingress Protection IP65	Protective Class
Inverter Topology non-isolated	Inverter Topology non-isolated	Over Voltage Category III (MAINS),II (
Protective Class I	Protective Class	
Over Voltage Category III (MAINS), II (DC)	Over Voltage Category III (MAINS), II (DC)	Grid Monitoring AS4777/ VDE-AR-N 4105/ CEI 0
Grid Monitoring AS4777/ VDE-AR-N 4105/ CEI 0-21 EN50438/ VDE0126-1-1/ G59	Grid Monitoring AS4777/ VDE-AR-N 4105/ CEI 0-21 EN50438/ VDE0126-1-1/ G59	EN50438/ VDE0126-1-1/ G59 DRM0 DRM1 DRM2 DRM3 DRM4 DRM5 DRM6 DRM7 DI
	DRM0 DRM1 DRM2 DRM3 DRM4 DRM5 DRM6 DRM7 DRM8	
Inverter SN:	Inverter SN:	Inverter SN:
Register SN:	Register SN:	Register SN:
Image: Construction of the second	Image: Constraint of the second se	C C Weight Weigh
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C OUTPUT & AC INPUT Iominal AC Voltage, Frequenc Iominal AC Apparent Power (y 230V~,50/60Hz
ominal AC Apparent Power for VI	
lax. AC Output/Input Current	
ower Factor at Rated Power	1
ower Factor Range	0.8 Leading - 0.8 Lagging
PS OUTPUT	
PS Nominal Voltage, Frequen	cy 230V~,50/60Hz
PS Nominal Apparent Power	5000VA
PS Rated Current	21.7A
ATTERY	
attery Type	Lithium
attery Voltage Operation Ran	
lax.Charge and discharge Cur	rrent 20A
THERS	
Operating Ambient Temperatu	re Range -2060°C
ngress Protection	IP65
werter Topology	non-isolated
rotective Class	I
wer Voltage Category	III (MAINS),II (DC
	VDE-AR-N 4105/ CEI 0-21 I/ VDE0126-1-1/ G59
RM0 DRM1 DRM2 DRM3 DRM	
gister : : : : : : : : : : : : : : : : : : :	▲ ▲ ▲ ⊚ ▲ ⊊·



General product information:

The Solar Inverter converts DC voltage into AC voltage.

The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit will also operate in case of one error.

The PV inverters can also be used with an energy storage system, utilize the advanced power conversion technology IGBT to convert DC to AC.



The internal control is redundant built, It consists of master controller(U2-A) and slave controller(U2-B), the master controller(U2-A) can control relays, measures voltage, frequency, AC current with injected DC, insulation resistance and residual current. The slave controller (U2-B) 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 protection device makes up of two in series in each line and netural between inverter and grid .Inverter and back-up load.Back-up load and grid.Communicative coupled AC relays so that the equipment could be effectively separated from utility even any one of relays short circuited or works unnormally.

The controlling section is also redundant built. one master DSP. and one slave DSP. The master DSP carries out the main calculation and driving instructions. Slave DSP is responsible for the redundant relay independently. In case any one of two chips breaks down or runs a wrong program, which result to the loss of protection funciton, the another chip could indicate the fault and disconnect the equipment immediately.

The Accreditation only attests the technical capability of the testing laboratory for the test covered by the accreditation" (in the case of case of test report issued under accreditation mark)



Model	X1-Hybrid- 3.0-N-E	X1-Hybrid- 3.0-D-E	X1-Hybrid- 3.7-N-E	X1-Hybrid- 3.7-D-E	X1-Hybrid- 4.6-N-E
power board		710.00162.00			
control board	710.70	548.00	710.60	458.00	710.50458.0 0
LCD board			710.00177.00		
USB Board			710.00197.00		
EMI Board			710.10218.00		
Model	X1-Hybrid- 4.6-D-E	X1-Hybrid- 5.0-N-E	X1-Hybrid- 5.0-D-E	X1-Fit-3.7E	X1-Fit-5.0E
power board		710.00162.00 710.10162.00			
control board	710.50548.0 0	710.40	548.00	710.J0458.0 0	710.E0458.0 0
LCD board		710.00177.00			
USB Board		710.00197.00			
EMI Board		710.10218.00 710.10270.0 710.1 0 710.10270.0 710.1			
ware Version:					
Model	X1-Hybrid-3.0-N-E X1-Hybrid-4.6-N-E	, X1-Hybrid-4.6		d-5.0-N-E, X1-H	
ARM			V2.03		
DSP master			V2.07		
DSP slave		V2.01			



Model	R411	R412	R413	R328	R62	DC switch	DC conne ctor
X1-Hybrid- 3.0-N-E	Y	N	N	N	N	N	Y
X1-Hybrid- 3.0-D-E	Y	N	N	N	N	Y	Y
X1-Hybrid- 3.7-N-E	N	Y	N	N	Ν	N	Y
X1-Hybrid- 3.7-D-E	N	Y	N	N	Ν	Y	Y
X1-Hybrid- 4.6-N-E	Y	Y	N	N	N	N	Y
X1-Hybrid- 4.6-D-E	Y	Y	N	N	N	Y	Y
X1-Hybrid- 5.0-N-E	N	N	N	N	Ν	N	Y
X1-Hybrid- 5.0-D-E	N	N	N	N	Ν	Y	Y
X1-Fit-3.7E	N	Y	N	Y	Y	N	N
X1-Fit-5.0E	N	N	Y	Y	Y	N	Ν

Description of the differences of the models within a series:

Note:

Y: have

N: haven't

Note:

The product was tested on:

The tests had been performed on model X1-Hybrid-5.0-D-E are valid for model X1-Hybrid-3.0-N-E, X1-Hybrid-3.0-D-E, X1-Hybrid-3.7-N-E, X1-Hybrid-3.7-D-E, X1-Hybrid-4.6-N-E, X1-Hybrid-4.6-D-E, X1-Hybrid-5.0-N-E, X1-Fit-3.7E,X1-Fit-5.0E since it is identical in hardware and just power derated by except for R411, R412, R413, R328, R62, DC Switch, DC Connector.

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Test overview:

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



6.1 Islanding protection

Test circuit and parameters

Parameter	Symbol	Units
EUT DC Input		
DC voltage	V _{DC}	V
DC Current	IDC	A
DC Power	PDC	W
EUT AC output		
AC voltage	Veut	V
AC current	I _{EUT}	A
Real power	PEUT	W
Reactive power	Q _{EUT}	VAr
Test Load		
Resistive load current	I _R	A
Inductive load current	۱L	A
Capacitive load current	lc	A
AC (utility) power source		
Utility real power	P _{AC}	W
Utility reactive power	Q _{AC}	VAr
Utility current	IAC	A



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6.1 Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)									Ρ		
	onditions	Distortion factor of chokes < 2% Quality = 1									
lir	Imit 2s (IEC 62116)										
Model: >	K1-Hybrid-∜	1	1	1	r		1	1	1		
No	P _{EUT} ¹⁾ [% of EUT rating]	Reactiv e load [% of Q_L in 6.1.d) 1]	P _{AC} ²⁾ [% of nomina I]	Q _{AC} ³⁾ [% of nomina I]	I _{AC} ⁴⁾ [A]	Р _{ЕUT} [kW]	V _{DC} [V]	Q _f [1]	Run on Time [ms]	Remar ks ⁵⁾	
1	100	100	0	0		5,0	443	1,00	104,1	BL	
2	100	100	-10	-10		5,0	443	0,91	384,1	IB	
3	100	100	-10	-5		5,0	443	0,95	86,1	IB	
4	100	100	-10	0		5,0	443	1,00	239,2	IB	
5	100	100	-10	+5		5,0	443	1,05	146,0	IB	
6	100	100	-10	+10		5,0	443	1,10	154,1	IB	
7	100	100	-5	-10	-	5,0	443	0,90	88,0	IB	
8	100	100	-5	-5		5,0	443	0,95	156,0	IB	
9	100	100	-5	0		5,0	443	1,00	284,0	IB	
10	100	100	-5	+5		5,0	443	1,05	164,0	IB	
11	100	100	-5	+10		5,0	443	1,10	156,0	IB	
12	100	100	0	-10		5,0	443	0,90	80,0	IB	
13	100	100	0	-5		5,0	443	0,95	64,0	IB	
14	100	100	0	+5		5,0	443	1,05	168,0	IB	
15	100	100	0	+10		5,0	443	1,10	156,0	IB	
16	100	100	+5	-10		5,0	443	0,90	112,0	IB	
17	100	100	+5	-5		5,0	443	0,95	98,0	IB	
18	100	100	+5	0		5,0	443	1,00	292,0	IB	
19	100	100	+5	+5		5,0	443	1,05	146,0	IB	
20	100	100	+5	+10		5,0	443	1,10	151,0	IB	

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21	100	100	+10	-10		5,0	443	0,90	134,0	IB
22	100	100	+10	-5		5,0	443	0,95	162,0	IB
23	100	100	+10	0		5,0	443	1,00	150,0	IB
24	100	100	+10	+5		5,0	443	1,05	178,0	IB
25	100	100	+10	+10		5,0	443	1,10	154,0	IB
Parameter at 0% per phase L= 33,69 mH				Н		R=10,58 Ω	2	С	=301,01 µ	F

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

¹⁾ P_{EUT}: EUT output power

²⁾ P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

 $^{3)}$ Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

⁴⁾ Fundamental of I_{AC} when RLC is adjusted

⁵⁾ BL: Balance condition, IB: Imbalance condition.

Condition A:

EUT output power PEUT = Maximum ⁶⁾

EUT input voltage $^{6)} = >75\%$ of rated input voltage range

⁶⁾ Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.

⁷⁾ Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 90 % of range =X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.







Load	Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)											
	Test conditio	ons		Dis	U⊾ tortion f	ency: 50+ =230+/-3 actor of c Quality =	Vac hokes					
C	Disconnection	limit				2s	(IEC 62	16)				
Mode	el: X1-Hybrid	-5.0-D-E										
No	P _{EUT} ¹⁾ [% of EUT rating]	Reactiv load [% c in 6.1.d)	of Q∟	P _{AC} ²⁾ [% of nominal]	Q _{AC} ³⁾ [% of nominal]	I _{AC} ⁴⁾ [A]	Р _{ЕUT} [kW]	V _{DC} [V]	Q _f [1]	Run o Time [ms]	Rei	mark s ⁵⁾
1	66	66		0	-5		3,3	377	0,95	5 114,0		IB
2	66	66		0	-4		3,3	377	0,96	6 122,0		IB
3	66	66		0	-3		3,3	377	0,97	7 101,0		IB
4	66	66		0	-2		3,3	377	0,98	3 72,1		IB
5	66	66		0	-1		3,3	377	0,99	9 132,0		IB
6	66	66		0	0		3,3	377	1,00) 132,0	E	BL
7	66	66		0	1		3,3	377	1,01	126,0		IB
8	66	66		0	2		3,3	377	1,02	92,1		IB
9	66	66		0	3		3,3	377	1,03	3 110,0		IB
10	66	66	66		4		3,3	377	1,04	158,0		IB
11	66	66		0	5		3,3	377	1,05	5 122,0		IB
Parameter at 0% per phaseL= 51,05 mHR= 10							R= 16,	03 Ω		C= 1	98,67 µF	-

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

¹⁾ P_{EUT}: EUT output power

²⁾ P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

³⁾ Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

⁴⁾ Fundamental of I_{AC} when RLC is adjusted

⁵⁾ BL: Balance condition, IB: Imbalance condition.

Condition B:

EUT output power $P_{EUT} = 50 \% - 66 \%$ of maximum

EUT input voltage $^{6)}$ = 50 % of rated input voltage range, ±10 %

⁶⁾ Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 50 % of range =X + 0,5 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.







Load	Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)										
	Test condition	ons		Frequency: 50+/-0,1Hz U _N =230+/-3Vac Distortion factor of chokes < 2% Quality =1							
C	Disconnection	limit				2	2s (IEC 62	2116)			
Mode	el: X1-Hybrid	-5.0-D-E									
No	P _{EUT} ¹⁾ [% of EUT rating]	Reactiv load [% c in 6.1.d)	of Q∟	P _{AC} ²⁾ [% of nominal]	Q _{AC} ³⁾ [% of nominal]	I _{AC} 4) [A]	P _{EUT} [kW]	V _{DC} [V]	Q _f [1]	limo	Romark
1	33	33		0	-5		1,65	210	0,9	5 166,0	IB
2	33	33		0	-4		1,65	210	0,96	6 116,0	IB
3	33	33		0	-3		1,65	210	0,9	7 162,0	IB
4	33	33		0	-2		1,65	210	0,98	3 158,0	IB
5	33	33		0	-1		1,65	210	0,99	9 112,0	IB
6	33	33		0	0		1,65	210	1,00	0 126,0	BL
7	33	33		0	1		1,65	210	1,0 ⁻	1 264,0	IB
8	33	33		0	2		1,65	210	1,02	2 212,0	IB
9	33	33		0	3		1,65	210	1,03	3 188,0	IB
10	33	33		0	4		1,65	210	1,04	4 194,0	IB
11	33	33		0	5		1,65	210	1,0	5 178,0	IB
			1						-		
Parameter at 0% per phase L= 102,1 mH R= 32,06 Ω C= 99,33							9,33 µF				

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

¹⁾ PEUT: EUT output power

²⁾ P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

³⁾ Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

⁴⁾ Fundamental of I_{AC} when RLC is adjusted

⁵⁾ BL: Balance condition, IB: Imbalance condition.

Condition B:

EUT output power PEUT = 25 % – 33 % $^{6)}$ of maximum

EUT input voltage $^{7)}$ = <20 % of rated input voltage range

⁶⁾ Or minimum allowable EUT output level if greater than 33 %.

⁷⁾ Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 10 % of range =X + 0,2 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.







Annex 1 Pictures of the unit

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Enclosure front view for all model



Enclosure rear view for all model



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Enclosure left view for all model



Enclosure right view for all model



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Enclosure top view for all model



Enclosure bottom view for X1-Hybrid-3.0-N-E, X1-Hybrid-3.7-N-E, X1-Hybrid-4.6-N-E, X1-Hybrid-5.0-N-E



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Annex 2

Test Equipment list

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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	23/Jan/19	22/Jan/20
3	Oscilloscope	A4089036SH	DL850	YOKOGAWA	29/Aug/18	28/Aug/19
4	High Voltage probe	A4089026SH	P5200A	Tektronix	23/Jan/19	22/Jan/20
5	Voltage probe	A4089004SH	P2220	Tektronix	10/Oct/18	09/Oct/19
6	Current probe	A4089009SH	P6139B	Tektronix	23/Jan/19	22/Jan/20
7	Current probe	A4089013SH	A622	Tektronix	23/Jan/19	22/Jan/20
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	Programmabl e DC source	A7040058SH	62150H-1000S	Chroma	-	-
17	Programmabl e DC source	A7040059SH	62150H-1000S	Chroma	-	-
18	Programmabl e DC source	A7040069SH	62150H-1000S	Chroma	-	-
19	Programmabl e DC source	A7040074SH	62150H-1000S	Chroma	-	-
20	Programmabl e 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	06/May/19	05/May/20
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 stystem	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	-	-