



TL-395

Test Report issued under the responsibility of:

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TEST REPORT
IEC 61727
Photovoltaic (PV) systems –
Characteristics of the utility interface

Report Number..... : 230301065GZU-001**Date of issue..... :** 04 April 2023**Total number of pages** 35 Pages

Name of Testing Laboratory preparing the Report Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Room 02, & 101/E201/E301/E401/E501/E601/E701/E801 of
Room 01 1-8/F., No. 7-2. Caipin Road, Science City, GETDD,
Guangzhou, Guangdong, China

Applicant's name INVT Solar Technology (Shenzhen) Co., Ltd.**Address..... :** 6th Floor, Block A, INVT Guangming Technology Building, Kejie
Fourth Road, Shutianpu Community, Matian Guangming District,
518000 Shenzhen, PEOPLE'S REPUBLIC OF CHINA.**Test specification:****Standard** IEC 61727:2004**Test procedure** Type approval**Non-standard test method** N/A**Test Report Form No. :** IEC61727B**Test Report Form(s) Originator :** TÜV SÜD Product Service GmbH**Master TRF** Dated 2017-11-03

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Test item description .:	Grid-tied Solar inverter				
Trade Mark	invt				
Manufacturer.....	Same as applicant				
Model/Type reference :	iMars XG3KTL-1M, iMars XG3KTL-2M, iMars XG3.68KTL, iMars XG4KTL, iMars XG4.2KTL, iMars XG4.6KTL, iMars XG5KTL, iMars XG6KTL, iMars XG7KTL, iMars XG7KTL1, iMars XG8KTL, iMars XG8KTL1, iMars XG10KTL, iMars XG10KTL1				
Ratings	Model	iMars XG3KTL-1M	iMars XG3KTL-2M	iMars XG3.68KTL	iMars XG4KTL
	Max. Input voltage	600Vdc			
	MPPT voltage range	80 – 580Vdc			
	Max. input current	20A	2*20A		
	Isc PV	26A	2*26A		
	Rated output power	3000W	3000W	3680W	4000W
	Max. Output power	3300VA	3300VA	3680VA	4400VA
	Nominal output voltage	230Vac			
	Max. output current	15A	15A	16A	20A
	Nominal output frequency	50/60 Hz			
	Power factor range	0.8Leading ~ 0.8Lagging			
	Safety level	Class I			
	Ingress protection	IP66			
	Operation ambient temperature	-30°C - +60°C			
	Software version	VA1.0			
	Model	iMars XG4.2KTL	iMars XG4.6KTL	iMars XG5KTL	iMars XG6KTL
	Max. Input voltage	600Vdc			
	MPPT voltage range	80 – 580Vdc			

Max. input current	2*20A			
Isc PV	2*26A			
Rated output power	4200W	4600W	5000W	6000W
Max. Output power	4620VA	5000VA	5500VA	6600VA
Nominal output voltage	230Vac			
Max. output current	21A	23A	25A	30A
Nominal output frequency	50/60 Hz			
Power factor range	0.8Leading ~ 0.8Lagging			
Safety level	Class I			
Ingress protection	IP66			
Operation ambient temperature	-30°C - +60°C			
Software version	VA1.0			
Model	iMars XG7KTL	iMars XG7KTL1	iMars XG8KTL	iMars XG8KTL1
Max. Input voltage	600Vdc			
MPPT voltage range	80 – 580Vdc			
Max. input current	2*20A	28A/14A	2*20A	28A/14A
Isc PV	2*26A	36.4A/18.2A	2*26A	36.4A/18.2A
Rated output power	7000W	7000W	8000W	8000W
Max. Output power	7700VA	7700VA	8800VA	8800VA
Nominal output voltage	230Vac			
Max. output current	35A	35A	40A	40A
Nominal output frequency	50/60 Hz			

Power factor range	0.8Leading ~ 0.8Lagging	
Safety level	Class I	
Ingress protection	IP66	
Operation ambient temperature	-30°C - +60°C	
Software version	VA1.0	
Model	iMars XG10KTL	iMars XG10KTL1
Max. Input voltage	600Vdc	
MPPT voltage range	80 – 580Vdc	
Max. input current	2*20A	28A/14A
Isc PV	2*26A	36.4A/18.2A
Rated output power	10000W	10000W
Max. Output power	10000VA	10000VA
Nominal output voltage	230Vac	
Max. output current	45.5A	45.5A
Nominal output frequency	50/60 Hz	
Power factor range	0.8Leading ~ 0.8Lagging	
Safety level	Class I	
Ingress protection	IP66	
Operation ambient temperature	-30°C - +60°C	
Software version	VA1.0	

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒	Testing Laboratory:	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Testing location/ address.....:		Room 02, & 101/E201/E301/E401/E501/E601/E701/E801 of Room 01 1-8/F., No. 7-2. Caipin Road, Science City, GETDD, Guangzhou, Guangdong, China
☐	Associated CB Testing Laboratory:	N/A
Testing location/ address.....:		N/A
Tested by (name, function, signature)		Gaison Li engineer <i>Gaison Li</i>
Approved by (name, function, signature)...		Jason Fu Supervisor <i>Jason Fu</i>
☐	Testing procedure: TMP/CTF Stage 1:	N/A
Testing location/ address.....:		N/A
Tested by (name, function, signature)		N/A
Approved by (name, function, signature)...		N/A
☐	Testing procedure: WMT/CTF Stage 2:	N/A
Testing location/ address.....:		N/A
Tested by (name + signature)		N/A
Witnessed by (name, function, signature) ..		N/A
Approved by (name, function, signature)...		N/A
☐	Testing procedure: SMT/CTF Stage 3 or 4:	N/A
Testing location/ address.....:		N/A
Tested by (name, function, signature)		N/A
Witnessed by (name, function, signature) ..		N/A
Approved by (name, function, signature)...		N/A
Supervised by (name, function, signature) :		N/A

List of Attachments (including a total number of pages in each attachment):

Appendix 1: photos (5 pages)

Summary of testing:
Tests performed (name of test and test clause):

All applicable tests

Testing location:

Intertek Testing Services Shenzhen Ltd.
Guangzhou Branch

Room 02, &
101/E201/E301/E401/E501/E601/E701/E801 of
Room 01 1-8/F., No. 7-2. Caipin Road, Science
City, GETDD, Guangzhou, Guangdong, China

Summary of compliance with National Differences:
List of countries addressed

N/A

☒ The product fulfils the requirements of IEC 61727:2004

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

invt Grid-tied Solar Inverter	
iMars XG3KTL-1M	
DC Input	
Vmax. PV	600V
MPPT Range	80V-580V
Max. Current	20A
Isc PV	26A
AC Output	
Nominal Voltage	230V
Max. Current	15A
Rated Power	3000W
Max. Output Power	3300VA
Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov
Environment	
Temperature	-30°C ~ +60°C
Protective Class	I
Inverter topology	Non-isolated
Ingress protection	IP66
	
	
Made in China	
INVT Solar Technology (Shenzhen) Co.,Ltd.	

invt Grid-tied Solar Inverter	
iMars XG3KTL-2M	
DC Input	
Vmax. PV	600V
MPPT Range	80V-580V
Max. Current	20A/20A
Isc PV	26A/26A
AC Output	
Nominal Voltage	230V
Max. Current	15A
Rated Power	3000W
Max. Output Power	3300VA
Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov
Environment	
Temperature	-30°C ~ +60°C
Protective Class	I
Inverter topology	Non-isolated
Ingress protection	IP66
	
	
Made in China	
INVT Solar Technology (Shenzhen) Co.,Ltd.	

invt Grid-tied Solar Inverter	
iMars XG3.68KTL	
DC Input	
Vmax. PV	600V
MPPT Range	80V-580V
Max. Current	20A/20A
Isc PV	26A/26A
AC Output	
Nominal Voltage	230V
Max. Current	16A
Rated Power	3680W
Max. Output Power	3680VA
Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov
Environment	
Temperature	-30°C ~ +60°C
Protective Class	I
Inverter topology	Non-isolated
Ingress protection	IP66
	
	
Made in China	
INVT Solar Technology (Shenzhen) Co.,Ltd.	

invt Grid-tied Solar Inverter	invt Grid-tied Solar Inverter	invt Grid-tied Solar Inverter
iMars XG4KTL	iMars XG4.2KTL	iMars XG4.6KTL
DC Input	DC Input	DC Input
Vmax. PV 600V	Vmax. PV 600V	Vmax. PV 600V
MPPT Range 80V-580V	MPPT Range 80V-580V	MPPT Range 80V-580V
Max. Current 20A/20A	Max. Current 20A/20A	Max. Current 20A/20A
Isc PV 26A/26A	Isc PV 26A/26A	Isc PV 26A/26A
AC Output	AC Output	AC Output
Nominal Voltage 230V	Nominal Voltage 230V	Nominal Voltage 230V
Max. Current 20A	Max. Current 21A	Max. Current 23A
Rated Power 4000W	Rated Power 4200W	Rated Power 4600W
Max. Output Power 4400VA	Max. Output Power 4620VA	Max. Output Power 5000VA
Frequency 50Hz/60Hz	Frequency 50Hz/60Hz	Frequency 50Hz/60Hz
Power factor range 0.80un~0.80ov	Power factor range 0.80un~0.80ov	Power factor range 0.80un~0.80ov
Environment	Environment	Environment
Temperature -30°C ~ +60°C	Temperature -30°C ~ +60°C	Temperature -30°C ~ +60°C
Protective Class I	Protective Class I	Protective Class I
Inverter topology Non-isolated	Inverter topology Non-isolated	Inverter topology Non-isolated
Ingress protection IP66	Ingress protection IP66	Ingress protection IP66
 Made in China INVT Solar Technology (Shenzhen) Co.,Ltd.	 Made in China INVT Solar Technology (Shenzhen) Co.,Ltd.	 Made in China INVT Solar Technology (Shenzhen) Co.,Ltd.

invt Grid-tied Solar Inverter	
iMars XG5KTL	
DC Input	
Vmax. PV	600V
MPPT Range	80V-580V
Max. Current	20A/20A
Isc PV	26A/26A
AC Output	
Nominal Voltage	230V
Max. Current	25A
Rated Power	5000W
Max. Output Power	5500VA
Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov
Environment	
Temperature	-30°C ~ +60°C
Protective Class	I
Inverter topology	Non-isolated
Ingress protection	IP66
CE  Made in China	
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invt Grid-tied Solar Inverter	
iMars XG6KTL	
DC Input	
Vmax. PV	600V
MPPT Range	80V-580V
Max. Current	20A/20A
Isc PV	26A/26A
AC Output	
Nominal Voltage	230V
Max. Current	30A
Rated Power	6000W
Max. Output Power	6600VA
Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov
Environment	
Temperature	-30°C ~ +60°C
Protective Class	I
Inverter topology	Non-isolated
Ingress protection	IP66
CE  Made in China	
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invt Grid-tied Solar Inverter	
iMars XG7KTL	
DC Input	
Vmax. PV	600V
MPPT Range	80V-580V
Max. Current	20A/20A
Isc PV	26A/26A
AC Output	
Nominal Voltage	230V
Max. Current	35A
Rated Power	7000W
Max. Output Power	7700VA
Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov
Environment	
Temperature	-30°C ~ +60°C
Protective Class	I
Inverter topology	Non-isolated
Ingress protection	IP66
CE  Made in China	
INVT Solar Technology (Shenzhen) Co.,Ltd.	

invt Grid-tied Solar Inverter iMars XG7KTL1		invt Grid-tied Solar Inverter iMars XG8KTL		invt Grid-tied Solar Inverter iMars XG8KTL1	
DC Input		DC Input		DC Input	
Vmax. PV	600V	Vmax. PV	600V	Vmax. PV	600V
MPPT Range	80V-580V	MPPT Range	80V-580V	MPPT Range	80V-580V
Max. Current	28A/14A	Max. Current	20A/20A	Max. Current	28A/14A
Isc PV	36.4A/18.2A	Isc PV	26A/26A	Isc PV	36.4A/18.2A
AC Output		AC Output		AC Output	
Nominal Voltage	230V	Nominal Voltage	230V	Nominal Voltage	230V
Max. Current	35A	Max. Current	40A	Max. Current	40A
Rated Power	7000W	Rated Power	8000W	Rated Power	8000W
Max. Output Power	7700VA	Max. Output Power	8800VA	Max. Output Power	8800VA
Frequency	50Hz/60Hz	Frequency	50Hz/60Hz	Frequency	50Hz/60Hz
Power factor range	0.80un~0.80ov	Power factor range	0.80un~0.80ov	Power factor range	0.80un~0.80ov
Environment		Environment		Environment	
Temperature	-30℃ ~ +60℃	Temperature	-30℃ ~ +60℃	Temperature	-30℃ ~ +60℃
Protective Class	I	Protective Class	I	Protective Class	I
Inverter topology	Non-isolated	Inverter topology	Non-isolated	Inverter topology	Non-isolated
Ingress protection	IP66	Ingress protection	IP66	Ingress protection	IP66
					
Made in China		Made in China		Made in China	
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invt		Grid-tied Solar Inverter
iMars XG10KTL		
DC Input		
Vmax. PV		600V
MPPT Range		80V-580V
Max. Current		20A/20A
Isc PV		26A/26A
AC Output		
Nominal Voltage		230V
Max. Current		45.5A
Rated Power		10000W
Max. Output Power		10000VA
Frequency		50Hz/60Hz
Power factor range		0.80un~0.80ov
Environment		
Temperature		-30°C ~ +60°C
Protective Class		I
Inverter topology		Non-isolated
Ingress protection		IP66
		
		
Made in China		
INVT Solar Technology (Shenzhen) Co.,Ltd.		

invt		Grid-tied Solar Inverter
iMars XG10KTL1		
DC Input		
Vmax. PV		600V
MPPT Range		80V-580V
Max. Current		28 /14 Ad.c.
Isc PV		36.4/18.2Ad.c
AC Output		
Nominal Voltage		230V
Max. Current		45.5A
Rated Power		10000W
Max. Output Power		10000VA
Frequency		50Hz/60Hz
Power factor range		0.80un~0.80ov
Environment		
Temperature		-30°C ~ +60°C
Protective Class		I
Inverter topology		Non-isolated
Ingress protection		IP66
		
		
Made in China		
INVT Solar Technology (Shenzhen) Co.,Ltd.		

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.

Test item particulars	
Classification of installation and use	Fixed and outdoor used
Supply Connection	Permanent connection
Possible test case verdicts:	
- test case does not apply to the test object.....: N/A	
- test object does meet the requirement.....: P (Pass)	
- test object does not meet the requirement.....: F (Fail)	
Testing.....	
Date of receipt of test item	06 Mar 2023
Date (s) of performance of tests	08 Mar 2023 – 31 Mar 2023

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.

"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

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

This report shall be used together with the report 230301065GZU-002.

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided

☐ **Yes**
☒ **Not applicable**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) Shenzhen INVT Electric Co., Ltd. (Baoan Factory)
4th to 1st floors of Emerson Industrial Park, No. 3,
Fengtang Avenue, Tangwei Community, Fuhai
Street, Baoan District, Shenzhen, CHINA.

General product information:

The inverter is a Grid-tied solar inverter, which converts the PV voltage into AC voltage, and feed into Grid.

The machine includes input and output EMI filtering and consists of Master CPU and Slave CPU.

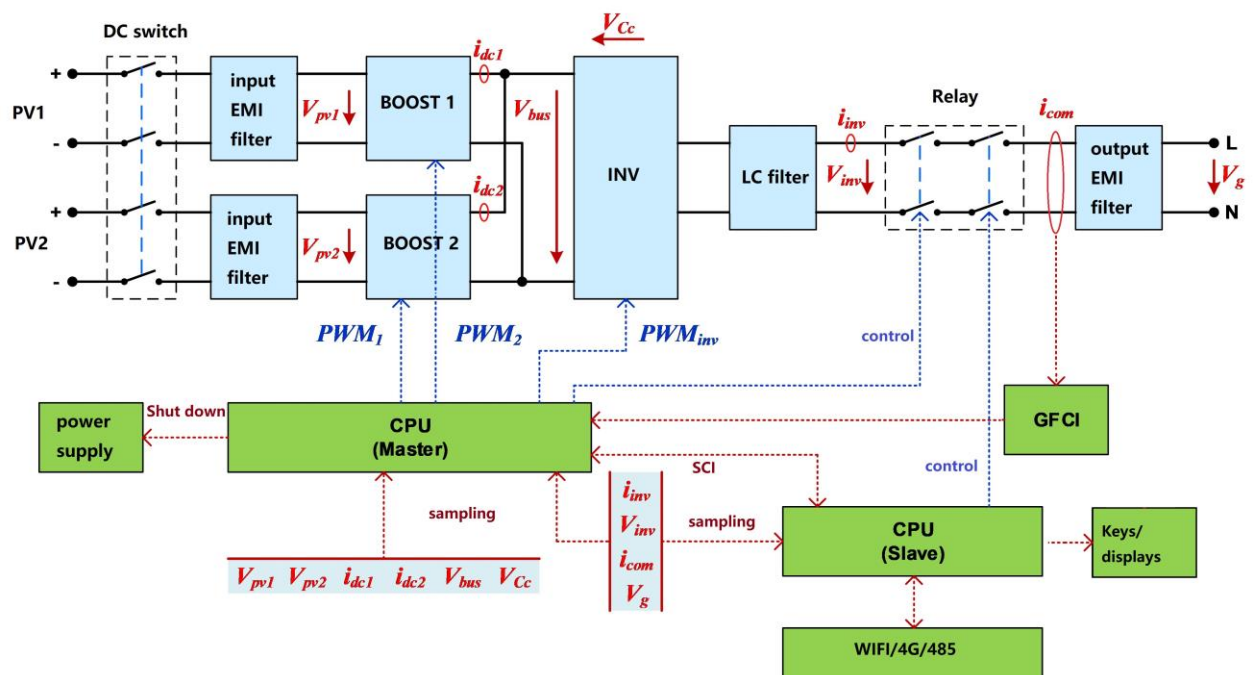
The Master CPU mainly monitors BUS voltage, the voltage, current, on the PV side, control the voltage boost of AC side, communicate with Slave CPU and participates in the inverter control.

Slave CPU can monitor output voltage, output current, for human-computer interaction communication and display, including RS485 communication, LED/LCD display.

There is an internal communication circuit between the two CPU to coordinate with each other to complete the software function of the whole machine.

The Master CPU and slave CPU are used together to control relay open or close, if the single fault on one controller, the other controller can be capable to open the relay, so that still providing safety means.

The topology diagram as following:



Model differences:

All models are identical, except the max. input current, PV Isc and some parameter of the software architecture in order to control the max output power.

All Models except iMars XG3KTL-1M have two MPPT trackers while model iMars XG3KTL-1M just has one MPPT trackers.

The product was tested on:

The Hardware version: 11006-00377

The Software version: VA1.0

Other than special notes, typical model iMars XG10KTL used as representative for testing in this report.

IEC61727			
Cl.	Requirement - Test	Result	Verdict
4	UTILITY COMPATIBILITY		P
	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.		P
	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.		P
4.1	Voltage, current and frequency		P
	The PV system AC voltage, current and frequency are compatible with the utility system.		P
4.2	Normal voltage operating range		P
	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.		P
4.3	Flicker		P
	The operation of the PV system is 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.		P
4.4	DC injection		P
	The PV system is not inject DC current greater than 1 % of the rated inverter output current, into the utility AC interface under any operating condition.	(See appended table)	P
4.5	Normal frequency operating range		P
	The PV system operates in synchronism with the utility system, and within the frequency trip limits defined in 5.2.2.		P
4.6	Harmonics and waveform distortion		P
	Total harmonic current distortion is less than 5 % at rated inverter output. Each individual harmonic is limited to the percentages listed in Table 1.	(See appended table)	P
	Even harmonics in these ranges is less than 25 % of the lower odd harmonic limits listed.		P

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IEC61727																					
Cl.	Requirement - Test	Result	Verdict																		
	<table><tr><th colspan="2">Table 1 – Current distortion limits</th></tr><tr><th>Odd harmonics</th><th>Distortion limit</th></tr><tr><td>3rd through 9th</td><td>Less than 4,0 %</td></tr><tr><td>11th through 15th</td><td>Less than 2,0 %</td></tr><tr><td>17th through 21st</td><td>Less than 1,5 %</td></tr><tr><td>23rd through 33rd</td><td>Less than 0,6 %</td></tr><tr><th>Even harmonics</th><th>Distortion limit</th></tr><tr><td>2rd through 8th</td><td>Less than 1,0 %</td></tr><tr><td>10th through 32nd</td><td>Less than 0,5 %</td></tr></table>	Table 1 – Current distortion limits		Odd harmonics	Distortion limit	3 rd through 9 th	Less than 4,0 %	11 th through 15 th	Less than 2,0 %	17 th through 21 st	Less than 1,5 %	23 rd through 33 rd	Less than 0,6 %	Even harmonics	Distortion limit	2 rd through 8 th	Less than 1,0 %	10 th through 32 nd	Less than 0,5 %		P
Table 1 – Current distortion limits																					
Odd harmonics	Distortion limit																				
3 rd through 9 th	Less than 4,0 %																				
11 th through 15 th	Less than 2,0 %																				
17 th through 21 st	Less than 1,5 %																				
23 rd through 33 rd	Less than 0,6 %																				
Even harmonics	Distortion limit																				
2 rd through 8 th	Less than 1,0 %																				
10 th through 32 nd	Less than 0,5 %																				
4.7	The PV system has a lagging power factor greater than 0,9 when the output is greater than 50 % of the rated inverter output power.		P																		
5	PERSONNEL SAFETY AND EQUIPMENT PROTECTION		P																		
	This Clause provides information and considerations for the safe and proper operation of the utility-connected PV systems.		P																		
5.1	Loss of utility voltage		P																		
	To prevent islanding, a utility connected PV system ceases to energize the utility system from a de-energized distribution line irrespective of connected loads or other generators within specified time limits.	Complied with IEC 62116, See the separate report for reference	P																		
	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.		P																		
5.2	Over/under voltage and frequency		P																		
	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.		P																		
5.2.1	Over/under voltage		P																		
	When the interface voltage deviates outside the conditions specified in Table 2, the photovoltaic system ceases to energize the utility distribution system. This applies to any phase of a multiphase system.	(See appended table)	P																		

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IEC61727																			
Cl.	Requirement - Test	Result	Verdict																
	<table><tr><th colspan="2">Table 2 – Response to abnormal voltages</th></tr><tr><th>Voltage (at point of utility connection)</th><th>Maximum trip time*</th></tr><tr><td>$V < 0,5 \times V_{nominal}$</td><td>0,1 s</td></tr><tr><td>$50 \% \leq V < 85 \%$</td><td>2,0 s</td></tr><tr><td>$85 \% \leq V \leq 110 \%$</td><td>Continuous operation</td></tr><tr><td>$110 \% < V < 135 \%$</td><td>2,0 s</td></tr><tr><td>$135 \% \leq V$</td><td>0,05 s</td></tr><tr><td colspan="2">* 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.</td></tr></table>	Table 2 – Response to abnormal voltages		Voltage (at point of utility connection)	Maximum trip time*	$V < 0,5 \times V_{nominal}$	0,1 s	$50 \% \leq V < 85 \%$	2,0 s	$85 \% \leq V \leq 110 \%$	Continuous operation	$110 \% < V < 135 \%$	2,0 s	$135 \% \leq V$	0,05 s	* 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.			P
Table 2 – Response to abnormal voltages																			
Voltage (at point of utility connection)	Maximum trip time*																		
$V < 0,5 \times V_{nominal}$	0,1 s																		
$50 \% \leq V < 85 \%$	2,0 s																		
$85 \% \leq V \leq 110 \%$	Continuous operation																		
$110 \% < V < 135 \%$	2,0 s																		
$135 \% \leq V$	0,05 s																		
* 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.																			
5.2.2	Over/under frequency		P																
	When the utility frequency deviates outside the specified conditions the photovoltaic system ceases 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.	(See appended table)	P																
	When the utility frequency is outside the range of ± 1 Hz, the system ceases 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.		P																
5.3	Islanding protection		P																
	The PV system must cease to energize the utility line within 2 s of loss of utility.		P																
5.4	Response to utility recovery		P																
	Following an out-of-range utility condition that has caused the photovoltaic system to cease energizing, the photovoltaic system is 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 appended table)	P																
5.5	Earthing		P																
	The utility interface equipment is earthed/grounded in accordance with IEC 60364-7-712.		P																
5.6	Short circuit protection		N/A																
	The photovoltaic system has short-circuit protection in accordance with IEC 60364-7-712.	Should consider in the end use	N/A																
5.7	Isolation and switching		N/A																
	A method of isolation and switching is provided in accordance with IEC 60364-7-712.	Should consider in the end use	N/A																

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Cl.	Requirement - Test	Result	Verdict

4.3	TABLE: Flicker				P
Model: iMars XG3KTL-2M (with 50Hz)					
	Starting	Stopping	Running		
Limit	4%	4%	Pst = 1.0	Plt = 0.65	
Test value	0.232	0.240	0.089	0.082	
Model: iMars XG3KTL-2M (with 60Hz)					
	Starting	Stopping	Running		
Limit	4%	4%	Pst = 1.0	Plt = 0.65	
Test value	0.236	0.241	0.334	0.306	
Model: iMars XG10KTL (with 50Hz)					
	Starting	Stopping	Running		
Limit	4%	4%	Pst = 1.0	Plt = 0.65	
Test value	0.775	0.792	0.575	0.535	
Model: iMars XG10KTL (with 60Hz)					
	Starting	Stopping	Running		
Limit	4%	4%	Pst = 1.0	Plt = 0.65	
Test value	0.574	0.571	0.582	0.579	
Supplementary information:					

IEC61727			
Cl.	Requirement - Test	Result	Verdict

4.4	TABLE: Direct current injection								P
Rated output current (A)	Ratio of rated output power (VA)	Measured DC output current between terminals						Isolated transformer ? (Yes/No)	Limit (mA)
		L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)		
Model: iMars XG3KTL-2M (with 50Hz)									
13.04	10%	--	--	--	34.45	--	--	No	130.4
13.04	50%	--	--	--	74.72	--	--	No	130.4
13.04	100%	--	--	--	91.79	--	--	No	130.4
Model: iMars XG3KTL-2M (with 60Hz)									
13.04	10%	--	--	--	48.84	--	--	No	130.4
13.04	50%	--	--	--	84.02	--	--	No	130.4
13.04	100%	--	--	--	89.07	--	--	No	130.4
Model: iMars XG10KTL (with 50Hz)									
43.48	10%	--	--	--	61.48	--	--	No	434.8
43.48	50%	--	--	--	102.31	--	--	No	434.8
43.48	100%	--	--	--	127.43	--	--	No	434.8
Model: iMars XG10KTL (with 60Hz)									
43.48	10%	--	--	--	57.66	--	--	No	434.8
43.48	50%	--	--	--	113.09	--	--	No	434.8
43.48	100%	--	--	--	125.07	--	--	No	434.8
Supplementary information:									

IEC61727			
Cl.	Requirement - Test	Result	Verdict

4.6	TABLE: Harmonics and waveform distortion							P
Model: iMars XG3KTL-2M (with 50Hz)								
Harmonic	fundamen tal L1 (A)	% of fundamen tal)	fundamen tal L2 (A)	% of fundamen tal)	fundamen tal L3 (A)	% of fundamen tal)	Harmonic Current Limits (%)	
02	0.1032	0.7916	--	--	--	--	1.0%	
03	0.2065	1.5833	--	--	--	--	4.0%	
04	0.0394	0.3019	--	--	--	--	1.0%	
05	0.0505	0.3875	--	--	--	--	4.0%	
06	0.0167	0.1278	--	--	--	--	1.0%	
07	0.0384	0.2946	--	--	--	--	4.0%	
08	0.0098	0.0755	--	--	--	--	1.0%	
09	0.0158	0.1209	--	--	--	--	4.0%	
10	0.0052	0.0401	--	--	--	--	0.5%	
11	0.0089	0.0679	--	--	--	--	2.0%	
12	0.0033	0.0254	--	--	--	--	0.5%	
13	0.0052	0.0401	--	--	--	--	2.0%	
14	0.0025	0.0190	--	--	--	--	0.5%	
15	0.0038	0.0288	--	--	--	--	2.0%	
16	0.0018	0.0135	--	--	--	--	0.5%	
17	0.0029	0.0222	--	--	--	--	1.5%	
18	0.0015	0.0112	--	--	--	--	0.5%	
19	0.0027	0.0205	--	--	--	--	1.5%	
20	0.0013	0.0099	--	--	--	--	0.5%	
21	0.0023	0.0176	--	--	--	--	1.5%	
22	0.0011	0.0081	--	--	--	--	0.5%	
23	0.0022	0.0166	--	--	--	--	0.6%	
24	0.0010	0.0077	--	--	--	--	0.5%	
25	0.0016	0.0122	--	--	--	--	0.6%	
26	0.0008	0.0065	--	--	--	--	0.5%	
27	0.0014	0.0105	--	--	--	--	0.6%	
28	0.0009	0.0066	--	--	--	--	0.5%	
29	0.0010	0.0079	--	--	--	--	0.6%	
30	0.0009	0.0065	--	--	--	--	0.5%	
31	0.0009	0.0065	--	--	--	--	0.6%	
32	0.0007	0.0054	--	--	--	--	0.5%	

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Cl.	Requirement - Test			Result			Verdict
33	0.0007	0.0056	--	--	--	--	0.6%
THD	1.911%		--		--		5%
Model: iMars XG3KTL-2M (with 60Hz)							
Harmonic	fundamen tal L1 (A)	% of fundamen tal)	fundamen tal L2 (A)	% of fundamen tal)	fundamen tal L3 (A)	% of fundamen tal)	Harmonic Current Limits (%)
02	0.1030	0.7895	--	--	--	--	1.0%
03	0.1977	1.5160	--	--	--	--	4.0%
04	0.0414	0.3173	--	--	--	--	1.0%
05	0.0394	0.3025	--	--	--	--	4.0%
06	0.0162	0.1239	--	--	--	--	1.0%
07	0.0275	0.2105	--	--	--	--	4.0%
08	0.0103	0.0792	--	--	--	--	1.0%
09	0.0115	0.0883	--	--	--	--	4.0%
10	0.0062	0.0474	--	--	--	--	0.5%
11	0.0072	0.0551	--	--	--	--	2.0%
12	0.0051	0.0389	--	--	--	--	0.5%
13	0.0059	0.0454	--	--	--	--	2.0%
14	0.0042	0.0321	--	--	--	--	0.5%
15	0.0044	0.0340	--	--	--	--	2.0%
16	0.0036	0.0273	--	--	--	--	0.5%
17	0.0042	0.0322	--	--	--	--	1.5%
18	0.0030	0.0232	--	--	--	--	0.5%
19	0.0038	0.0293	--	--	--	--	1.5%
20	0.0028	0.0211	--	--	--	--	0.5%
21	0.0031	0.0239	--	--	--	--	1.5%
22	0.0025	0.0189	--	--	--	--	0.5%
23	0.0027	0.0204	--	--	--	--	0.6%
24	0.0023	0.0173	--	--	--	--	0.5%
25	0.0024	0.0181	--	--	--	--	0.6%
26	0.0021	0.0157	--	--	--	--	0.5%
27	0.0021	0.0161	--	--	--	--	0.6%
28	0.0019	0.0148	--	--	--	--	0.5%
29	0.0019	0.0143	--	--	--	--	0.6%
30	0.0018	0.0138	--	--	--	--	0.5%
31	0.0017	0.0132	--	--	--	--	0.6%
32	0.0017	0.0128	--	--	--	--	0.5%

IEC61727							
Cl.	Requirement - Test			Result			Verdict
33	0.0016	0.0125	--	--	--	--	0.6%
THD	1.813%		--		--		5%
Model: iMars XG10KTL (with 50Hz)							
Harmonic	fundamen tal L1 (A)	% of fundamen tal)	fundamen tal L2 (A)	% of fundamen tal)	fundamen tal L3 (A)	% of fundamen tal)	Harmonic Current Limits (%)
02	0.1489	0.3424	--	--	--	--	1.0%
03	1.0379	2.3870	--	--	--	--	4.0%
04	0.0548	0.1261	--	--	--	--	1.0%
05	0.1429	0.3288	--	--	--	--	4.0%
06	0.0331	0.0761	--	--	--	--	1.0%
07	0.1478	0.3399	--	--	--	--	4.0%
08	0.0137	0.0315	--	--	--	--	1.0%
09	0.0182	0.0419	--	--	--	--	4.0%
10	0.0055	0.0128	--	--	--	--	0.5%
11	0.0221	0.0507	--	--	--	--	2.0%
12	0.0046	0.0106	--	--	--	--	0.5%
13	0.0104	0.0238	--	--	--	--	2.0%
14	0.0024	0.0054	--	--	--	--	0.5%
15	0.0066	0.0152	--	--	--	--	2.0%
16	0.0020	0.0047	--	--	--	--	0.5%
17	0.0051	0.0117	--	--	--	--	1.5%
18	0.0018	0.0042	--	--	--	--	0.5%
19	0.0034	0.0079	--	--	--	--	1.5%
20	0.0013	0.0030	--	--	--	--	0.5%
21	0.0058	0.0134	--	--	--	--	1.5%
22	0.0011	0.0025	--	--	--	--	0.5%
23	0.0050	0.0115	--	--	--	--	0.6%
24	0.0012	0.0027	--	--	--	--	0.5%
25	0.0040	0.0091	--	--	--	--	0.6%
26	0.0009	0.0020	--	--	--	--	0.5%
27	0.0032	0.0074	--	--	--	--	0.6%
28	0.0009	0.0020	--	--	--	--	0.5%

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Cl.	Requirement - Test			Result			Verdict
29	0.0018	0.0041	--	--	--	--	0.6%
30	0.0009	0.0021	--	--	--	--	0.5%
31	0.0015	0.0035	--	--	--	--	0.6%
32	0.0007	0.0016	--	--	--	--	0.5%
33	0.0014	0.0033	--	--	--	--	0.6%
THD	2.533 %		--		--		5%
Model: iMars XG10KTL (with 60Hz)							
Harmonic	fundamen tal L1 (A)	% of fundamen tal)	fundamen tal L2 (A)	% of fundamen tal)	fundamen tal L3 (A)	% of fundamen tal)	Harmonic Current Limits (%)
02	0.2639	0.6069	--	--	--	--	1.0%
03	1.0975	2.5241	--	--	--	--	4.0%
04	0.2787	0.6409	--	--	--	--	1.0%
05	0.2157	0.4961	--	--	--	--	4.0%
06	0.1564	0.3597	--	--	--	--	1.0%
07	0.1443	0.3318	--	--	--	--	4.0%
08	0.1077	0.2478	--	--	--	--	1.0%
09	0.0944	0.2171	--	--	--	--	4.0%
10	0.0796	0.1830	--	--	--	--	0.5%
11	0.0688	0.1583	--	--	--	--	2.0%
12	0.0628	0.1443	--	--	--	--	0.5%
13	0.0583	0.1341	--	--	--	--	2.0%
14	0.0532	0.1222	--	--	--	--	0.5%
15	0.0491	0.1129	--	--	--	--	2.0%
16	0.0458	0.1053	--	--	--	--	0.5%
17	0.0425	0.0977	--	--	--	--	1.5%
18	0.0399	0.0918	--	--	--	--	0.5%
19	0.0386	0.0889	--	--	--	--	1.5%
20	0.0360	0.0829	--	--	--	--	0.5%
21	0.0344	0.0791	--	--	--	--	1.5%
22	0.0325	0.0747	--	--	--	--	0.5%
23	0.0311	0.0714	--	--	--	--	0.6%
24	0.0295	0.0679	--	--	--	--	0.5%

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Cl.	Requirement - Test				Result		Verdict
25	0.0286	0.0658	--	--	--	--	0.6%
26	0.0272	0.0625	--	--	--	--	0.5%
27	0.0263	0.0604	--	--	--	--	0.6%
28	0.0252	0.0579	--	--	--	--	0.5%
29	0.0244	0.0561	--	--	--	--	0.6%
30	0.0235	0.0540	--	--	--	--	0.5%
31	0.0228	0.0524	--	--	--	--	0.6%
32	0.0220	0.0507	--	--	--	--	0.5%
33	0.0213	0.0490	--	--	--	--	0.6%
THD	3.665 %		--		--		5%
Supplementary information:							

IEC61727			
Cl.	Requirement - Test	Result	Verdict

4.7	TABLE: Power factor							P
Model: iMars XG3KTL-2M (with 50Hz)								
	Input			Output				
No	Voltage (V d.c.)	Curre nt (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	Rated output (V.A)
1	359.99	1.78	628.15	230.03	3.15	598.27	0.8268	(20±5)%
2	359.98	2.65	942.07	230.09	4.08	902.88	0.9611	(30±5)%
3	359.96	3.55	1263.12	230.15	5.41	1216.07	0.9768	(40±5)%
4	359.95	4.44	1580.49	230.20	6.73	1525.03	0.9843	(50±5)%
5	359.94	5.29	1881.38	230.25	7.99	1817.61	0.9885	(60±5)%
6	359.93	6.18	2197.38	230.31	9.31	2124.27	0.9911	(70±5)%
7	359.93	6.96	2476.00	230.36	10.47	2395.27	0.9927	(80±5)%
8	359.91	7.86	2797.30	230.41	11.82	2706.79	0.9940	(90±5)%
9	359.90	8.75	3112.97	230.47	13.14	3012.60	0.9950	(100±5)%
Model: iMars XG3KTL-2M (with 60Hz)								
	Input			Output				
No	Voltage (V d.c.)	Curre nt (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	Rated output (V.A)
1	359.98	1.78	627.54	229.94	3.23	596.08	0.8035	(20±5)%
2	359.96	2.65	943.20	230.00	4.14	903.12	0.9480	(30±5)%
3	359.95	3.55	1262.16	230.05	5.45	1213.96	0.9686	(40±5)%
4	359.93	4.44	1580.28	230.11	6.76	1523.39	0.9788	(50±5)%
5	359.92	5.31	1887.18	230.16	8.04	1821.66	0.9844	(60±5)%
6	359.92	6.20	2201.99	230.22	9.35	2127.43	0.9880	(70±5)%
7	359.91	6.98	2479.97	230.27	10.51	2397.02	0.9901	(80±5)%
8	359.90	7.86	2794.36	230.32	11.83	2701.64	0.9919	(90±5)%
9	359.90	8.74	3108.91	230.37	13.14	3006.05	0.9931	(100±5)%
Model: iMars XG10KTL (with 50Hz)								
	Input			Output				
No	Voltage (V d.c.)	Curre nt (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	Rated output (V.A)

IEC61727								
Cl.	Requirement - Test					Result		Verdict
1	359.94	7.15	2047.55	230.31	8.67	1978.48	0.9904	(20±5)%
2	359.92	11.26	3054.95	230.50	12.88	2954.39	0.9949	(30±5)%
3	359.90	15.54	4102.71	230.69	17.25	3965.17	0.9966	(40±5)%
4	359.88	19.64	5122.91	230.87	21.47	4945.23	0.9975	(50±5)%
5	359.86	23.76	6169.03	231.06	25.78	5945.81	0.9980	(60±5)%
6	359.85	27.76	7210.43	231.26	30.05	6937.56	0.9984	(70±5)%
7	359.65	31.37	8247.70	231.48	34.25	7916.22	0.9904	(80±5)%
8	358.81	34.39	9250.10	231.67	38.29	8857.99	0.9903	(90±5)%
9	357.35	37.39	10283.14	231.86	42.44	9827.50	0.9988	(100±5)%
Model: iMars XG10KTL (with 60Hz)								
No	Input			Output				Rated output (V.A)
	Voltage (V d.c.)	Current (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	
1	359.94	5.88	2089.07	230.20	8.88	2016.41	0.9868	(20±5)%
2	359.91	8.76	3113.67	230.38	13.15	3007.73	0.9931	(30±5)%
3	359.87	11.70	4161.82	230.56	17.58	4016.61	0.9910	(40±5)%
4	359.83	14.56	5181.56	230.74	21.78	4993.78	0.9939	(50±5)%
5	359.80	17.54	6243.78	230.93	26.15	6008.35	0.9950	(60±5)%
6	359.76	20.68	7362.49	231.13	30.79	7085.91	0.9958	(70±5)%
7	359.73	23.68	8433.13	231.32	35.02	8069.85	0.9962	(80±5)%
8	359.69	26.46	9425.14	231.49	39.05	9010.72	0.9967	(90±5)%
9	359.66	29.36	10456.09	231.64	43.20	9976.45	0.9969	(100±5)%
Supplementary information: Power factor with "+" indicating leading and "-" indicating lagging.								

IEC61727			
Cl.	Requirement - Test	Result	Verdict

5.2.1 & 5.4		TABLE: Under-and over-voltage trip settings and reconnection test					P
(1) Under voltage disconnection procedure							
Rated output voltage (V)	Output power (VA)	Required min. voltage (V)	Value of PCE trip settings (V)	Ratio of decreased (V / s)	Interval time (s)	Measured tripped voltage (V)	Measured disconnection time (s)
230	10000	195.5	195.5	0.22	4	195.22	1.82
Rated output voltage (V)	Output power (VA)	Required min. voltage (V)	Value of PCE trip settings (V)	Ratio of decreased (V / s)	Interval time (s)	Measured tripped voltage (V)	Measured disconnection time (s)
230	10000	115	115	0.22	0.1	115.18	0.025
(2) Under voltage reconnection procedure							
Ratio of voltage rapidly decreased (V / s)			Reconnection voltage (V)		Reconnection time (s)		
0.22			>195.5		72.5		
(3) Over voltage disconnection procedure							
Rated output voltage (V)	Output power (VA)	Required max. voltage (V)	Value of PCE trip settings (V)	Ratio of increased (V / s)	Interval time (s)	Measured tripped voltage (V)	Measured disconnection time (s)
230	10000	253	253	0.22	4	253.12	1.80
Rated output voltage (V)	Output power (VA)	Required max. voltage (V)	Value of PCE trip settings (V)	Ratio of increased (V / s)	Interval time (s)	Measured tripped voltage (V)	Measured disconnection time (s)
230	10000	290*	290	0.22	0.1	291.73	0.010
(4) Over voltage reconnection procedure							
Ratio of voltage rapidly decreased (V / s)			Reconnection voltage (V)		Reconnection time (s)		
0.22			<253		73.1		
Supplementary information:							
Tested on model iMars XG10KTL							
*Remark: Limited by the max. output voltage of inverter.							

IEC61727			
Cl.	Requirement - Test	Result	Verdict

5.2.2 & 5.4		TABLE: Over/under frequency trip settings and reconnection test						P
(1) Under frequency disconnection procedure								
Rated output frequency (Hz)	Output power (VA)	Required min. frequency (Hz)	Value of PCE trip settings (Hz)	Ratio of decreased (Hz / s)	Interval time (s)	Measured tripped frequency (Hz)	Measured disconnection time (s)	
60	10000	59	59	0.01	0.3	59.05	0.160	
(2) Under frequency reconnection procedure								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			>59		72.82			
(3) Over frequency disconnection procedure								
Rated output frequency (Hz)	Output power (VA)	Required max. frequency (Hz)	Value of PCE trip settings (Hz)	Ratio of increased (Hz / s)	Interval time (s)	Measured tripped frequency (Hz)	Measured disconnection time (s)	
60	10000	61	61	0.01	0.3	60.98	0.119	
(4) Over frequency reconnection procedure								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			<61		78.72			
Supplementary information:								
Tested on model iMars XG10KTL with frequency 60Hz								

IEC61727			
Cl.	Requirement - Test	Result	Verdict

5.2.2 & 5.4		TABLE: Over/under frequency trip settings and reconnection test						P
(1) Under frequency disconnection procedure								
Rated output frequency (Hz)	Output power (VA)	Required min. frequency (Hz)	Value of PCE trip settings (Hz)	Ratio of decreased (Hz / s)	Interval time (s)	Measured tripped frequency (Hz)	Measured disconnection time (s)	
50	10000	49	49	0.01	0.3	49.02	0.172	
(2) Under frequency reconnection procedure								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			>49		73.46			
(3) Over frequency disconnection procedure								
Rated output frequency (Hz)	Output power (VA)	Required max. frequency (Hz)	Value of PCE trip settings (Hz)	Ratio of increased (Hz / s)	Interval time (s)	Measured tripped frequency (Hz)	Measured disconnection time (s)	
50	10000	51	51	0.01	0.3	51.00	0.197	
(4) Over frequency reconnection procedure								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			<51		74.86			
Supplementary information:								
Tested on model iMars XG10KTL with frequency 50Hz								

IEC61727			
Cl.	Requirement - Test	Result	Verdict

5.3	TABLE: tested condition and run-on time	P
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Model: Tested on model iMars XG10KTL

No.	P _{EUT} (% of EUT rating)	Reactive load (% of normal)	P _{AC}	Q _{AC}	Run-on time(ms)	P _{EUT} (KW)	Actual Q _f (Var)	V _{DC} (V)	Which load is selected to be adjusted (R or L)
Test condition A									
1	100	100	0	0	521	10	1.00	400	/
2	100	100	-5	-5	334	10	1.03	400	/
3	100	100	-5	0	313	10	1.05	400	/
4	100	100	-5	+5	265	10	1.07	400	/
5	100	100	0	-5	314	10	0.98	400	/
6	100	100	0	+5	291	10	1.03	400	/
7	100	100	+5	-5	303	10	0.94	400	/
8	100	100	+5	0	328	10	0.97	400	/
9	100	100	+5	+5	401	10	0.99	400	/
Test condition B									
10	66	66	0	0	310	6.6	1.00	300	/
11	66	66	0	-5	214	6.6	0.98	300	L
12	66	66	0	-4	223	6.6	0.99	300	L
13	66	66	0	-3	213	6.6	0.99	300	L
14	66	66	0	-2	217	6.6	1.00	300	L
15	66	66	0	-1	206	6.6	1.00	300	L
16	66	66	0	1	227	6.6	1.01	300	L
17	66	66	0	2	202	6.6	1.02	300	L
18	66	66	0	3	264	6.6	1.02	300	L
19	66	66	0	4	260	6.6	1.03	300	L
20	66	66	0	5	232	6.6	1.02	300	L
Test condition C									
21	33	33	0	0	218	3.3	1.00	160	/
22	33	33	0	-5	152	3.3	0.98	160	L
23	33	33	0	-4	140	3.3	0.99	160	L
24	33	33	0	-3	148	3.3	0.99	160	L
25	33	33	0	-2	178	3.3	0.99	160	L
26	33	33	0	-1	154	3.3	0.99	160	L
27	33	33	0	1	204	3.3	1.01	160	L
28	33	33	0	2	137	3.3	1.02	160	L
29	33	33	0	3	126	3.3	1.02	160	L
30	33	33	0	4	208	3.3	1.02	160	L
31	33	33	0	5	174	3.3	1.03	160	L

Supplementary information:

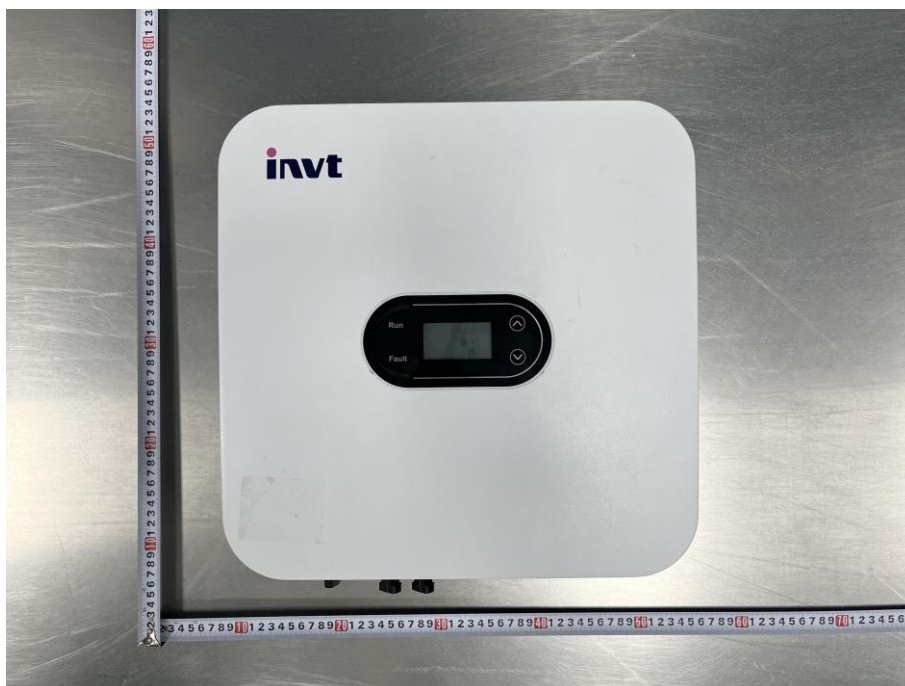
For test condition A:

If any of the recorded run-on times are longer than the one recorded for the rated balance condition, then the non-shaded parameter combinations also require testing.

For test condition B and C:

If run-on times are still increasing at the 95 % or 105 % points, additional 1 % increments is taken until run-on times begin decreasing.

Appendix 1: Photos

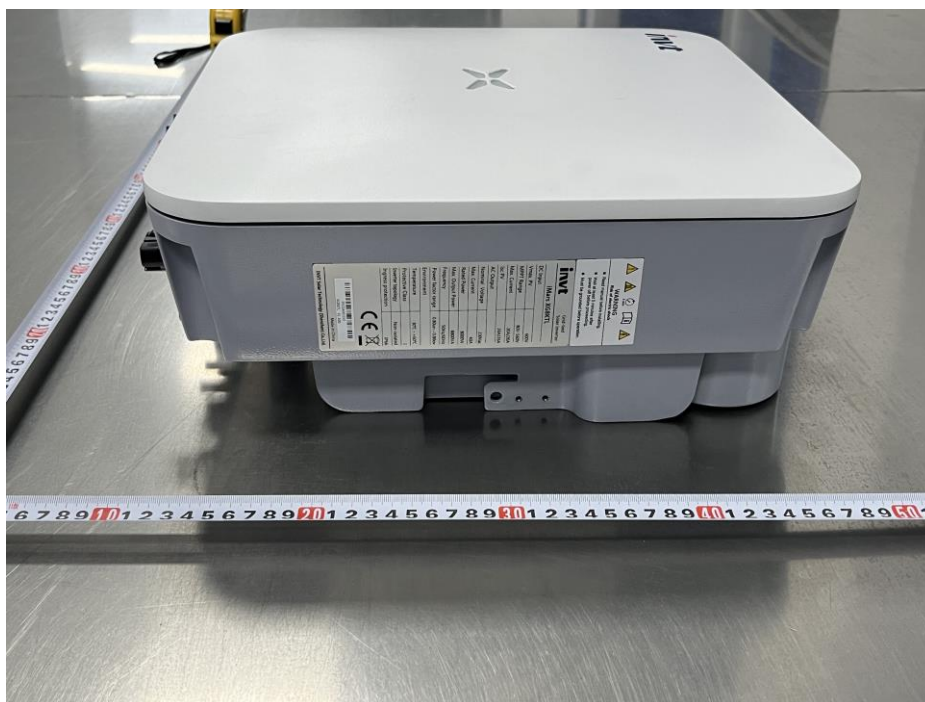


Overview 1



Overview 2

Appendix 1: Photos



Side view

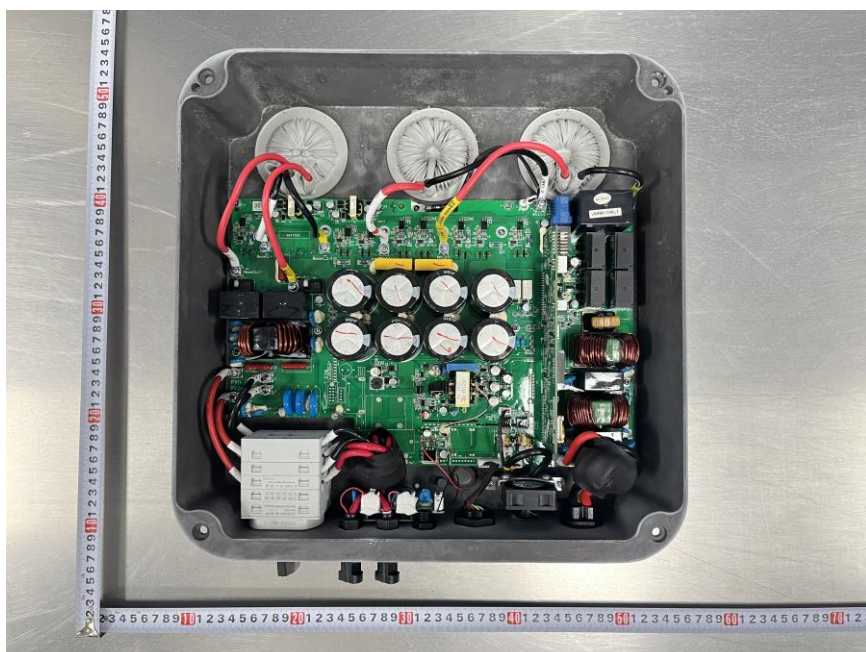


Top view

Appendix 1: Photos

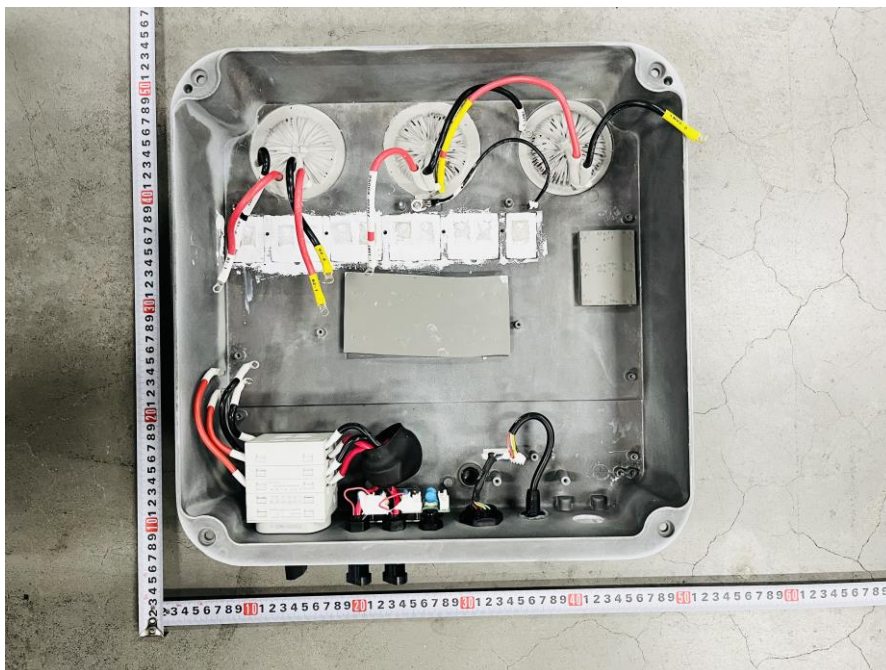


Connection view

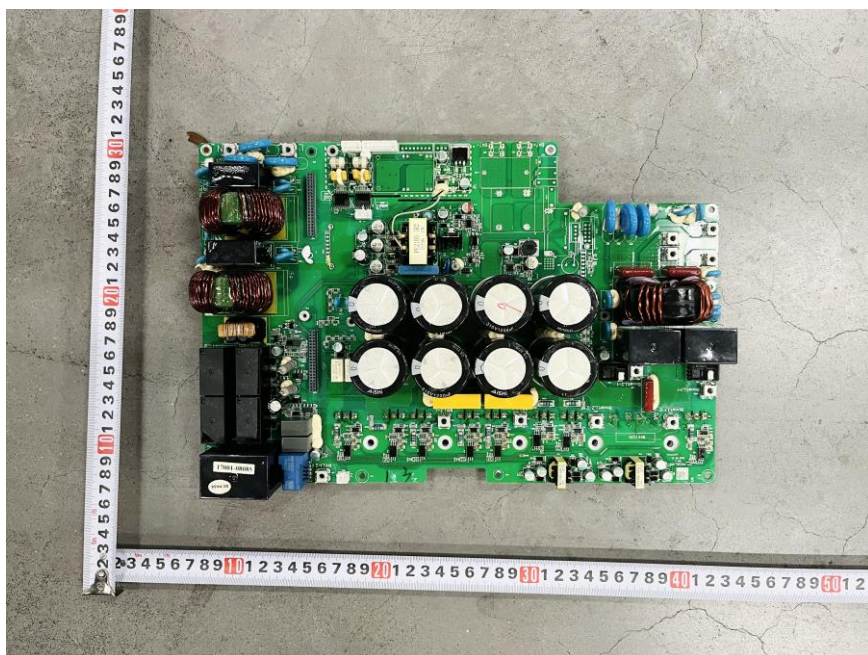


Internal view

Appendix 1: Photos

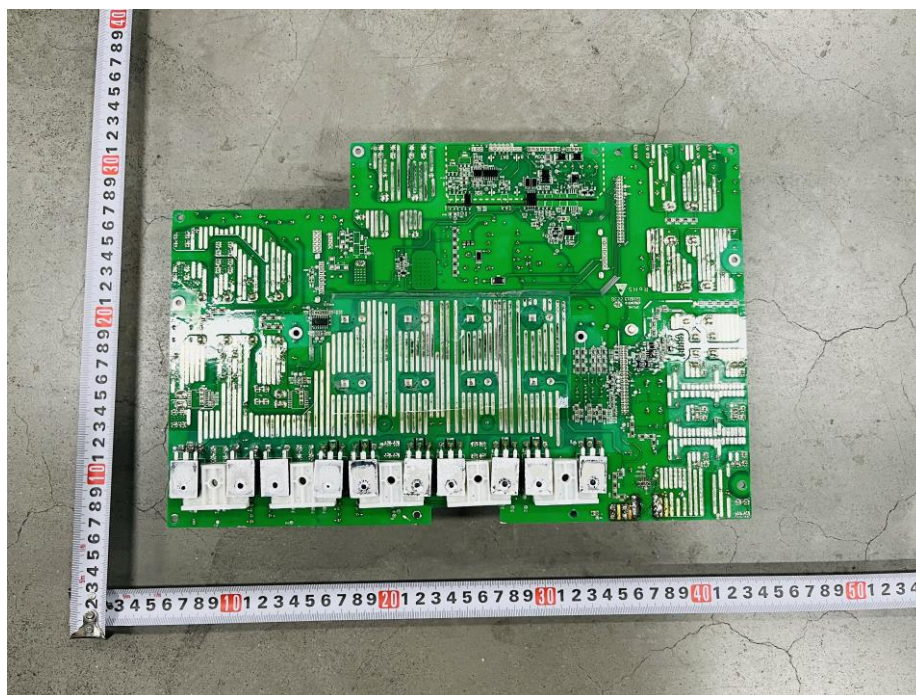


Internal view (Remove all PCB)



Power board view (Components side)

Appendix 1: Photos



Power board view (Reverse)

--- End of test report---