TL-395

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

Report Number. ..... :	220308046GZU-001
Date of issue ..... :	30 May 2022
Total number of pages ..... :	26 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 ..... :	Shenzhen Growatt New Energy Co., Ltd.
Address ..... :	4-13/F, Building A, Sino-German (Europe) Industrial Park, Hangcheng Ave, Bao'an District, Shenzhen, 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

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
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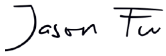
Test item description . :	PV Grid inverter
Trade Mark ..... :	GROWATT
Manufacturer..... :	Same as applicant
Model/Type reference :	MAX 50KTL3-XL2, MAX 60KTL3-XL2, MAX 70KTL3-XL2, MAX 73KTL3-XL2 MAX 75KTL3-XL2, MAX 50KTL3-XL1, MAX 60KTL3-XL1, MAX 70KTL3-XL1, MAX 73KTL3-XL1, MAX 75KTL3-XL1
Ratings ..... :	

Model	MAX 50KTL3-XL2	MAX 60KTL3-XL2	MAX 70KTL3-XL2	MAX 73KTL3-XL2	MAX 75KTL3-XL2
Max.PV voltage	1100Vdc				
MPPT voltage	180-850Vdc				
Max.input current	8*45A				
PV Isc	8*56.5A				
Nominal output voltage	3W/N/PE, 127/220Vac				
Nominal output Frequency	50/60Hz				
Max.output current	144.3A	173.2A	183.7A	191.6A	196.9A
Max. output power	50KW	60KW	70KW	73KW	75KW
Max. apparent power	55KVA	66KVA	70KVA	73KVA	75KVA
Power factor range	0.8Leading~0.8Lagging				
Safety level	Class I				
Ingress Protection	IP 66				
Operation Ambient Temperature	-30℃ - +60℃				
Software version	TN1.0				
Model	MAX 50KTL3-XL1	MAX 60KTL3-XL1	MAX 70KTL3-XL1	MAX 73KTL3-XL1	MAX 75KTL3-XL1

	Max.PV voltage	1100Vdc				
	MPPT voltage	180-850Vdc				
	Max.input current	10*32A				
	PV Isc	10*40A				
	Nominal output voltage	3W/N/PE, 127/220Vac				
	Nominal output Frequency	50/60Hz				
	Max.output current	144.3A	173.2A	183.7A	191.6A	196.9A
	Max. output power	50KW	60KW	70KW	73KW	75KW
	Max. apparent power	55KVA	66KVA	70KVA	73KVA	75KVA
	Power factor range	0.8Leading~0.8Lagging				
	Safety level	Class I				
	Ingress Protection	IP 66				
	Operation Ambient Temperature	-30℃ - +60℃				
	Software version	TN1.0				

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).....:		Joss Huang Engineer	
Approved by (name, function, signature)...:		Jason Fu Supervisor	
☐	**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 (3 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All applicable tests	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.

GROWATT PV Grid Inverter	
Model name	MAX 75KTL3-XL1
Max. PV voltage	1100 d.c.V
PV voltage range	180-850 d.c.V
PV Isc	32 d.c.A*10
Max. input current	40 d.c.A*10
Max. output power	75 kW
Max. apparent power	75 kVA
Nominal output voltage	3W/N/PE 127/220 a.c.V
Max. output current	196.9 a.c.A
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

VDE0126-1-1

Made in China

GROWATT PV Grid Inverter	
Model name	MAX 75KTL3-XL2
Max. PV voltage	1100 d.c.V
PV voltage range	180-850 d.c.V
PV Isc	56.5 d.c.A*8
Max. input current	45 d.c.A*8
Max. output power	75 kW
Max. apparent power	75 kVA
Nominal output voltage	3W/N/PE 127/220 a.c.V
Max. output current	196.9 a.c.A
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

VDE0126-1-1

Made in China

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation.
3. Other labels are identical to above, except the model's name and ratings

Test item particulars.....:	
Classification of installation and use.....:	Fixed and outdoor use
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 April 2022
Date (s) of performance of tests.....:	06 April 2022 to 10 May 2022

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 220308046GZU-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) ..... :	Guangdong Growatt New Energy Co., Ltd. Growatt Industrial Park,No.17 Pingheng Road Pingtan Town,Huiyang District,Huizhou,Guangdong, China

General product information:

The unit is a three-phase PV Grid inverter, it can convert the high PV voltage to Grid voltage and feed into Grid network.

The unit is providing EMC filtering at the PV side and AC side. It is transformerless between the PV circuit and AC circuit.

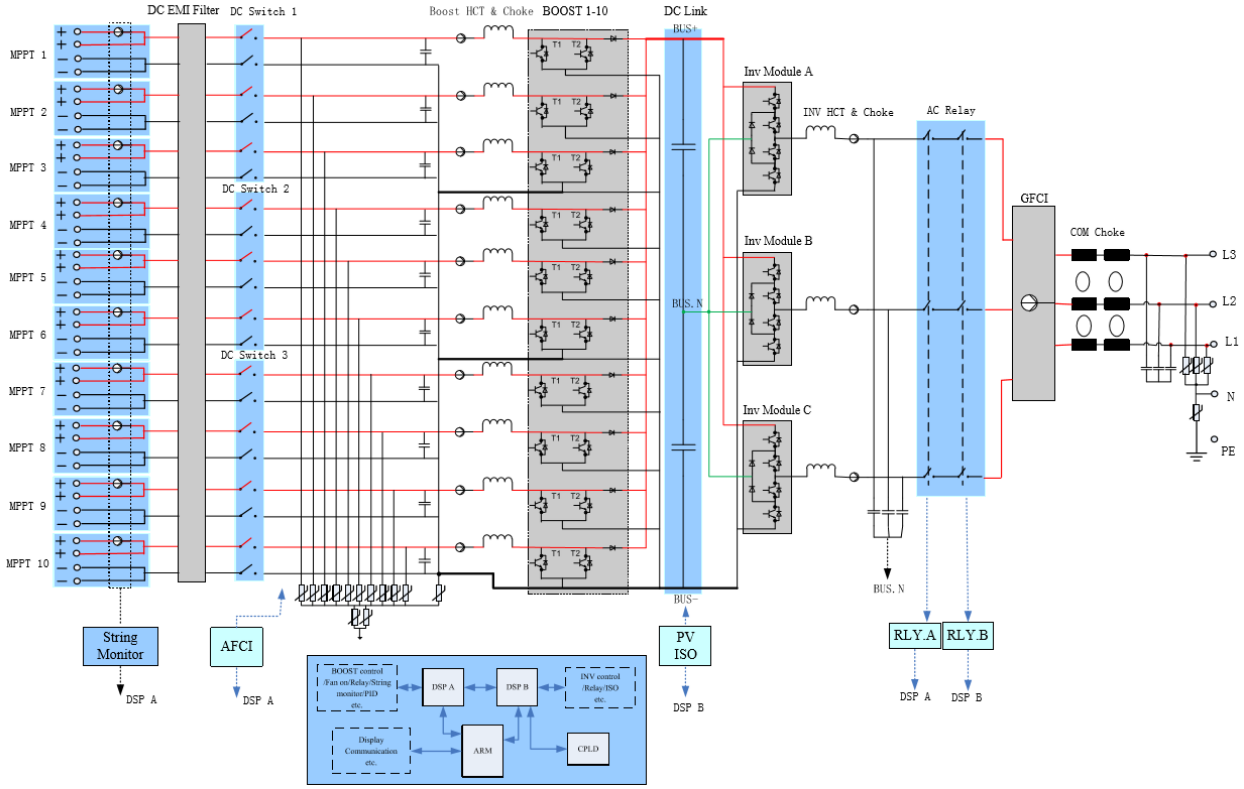
The unit has three controllers. The master controller DSP A measure the PV voltage and current, AFCI, PV ISO and also communicate with the slave controller B and slave controller ARM and etc; The slave controller DSP B is used to INV control and PV ISO measurement and etc.

The slave controller ARM monitor AC voltage, GFCI and communicate with the master controller DSP

The relays are designed to redundant structure that controlled by separately.

The master controller A and slave controller B 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:



Difference of models:

All models are identical, except the number of MPPT and the output power derating in software.

Other than special notice, the model MAX 75KTL3-XL2 is as the representative test model 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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	Table 1 – Current distortion limits **Odd harmonics** / **Distortion limit** 3rd through 9th — Less than 4,0 % 11th through 15th — Less than 2,0 % 17th through 21st — Less than 1,5 % 23rd through 33rd — Less than 0,6 % **Even harmonics** / **Distortion limit** 2nd through 8th — Less than 1,0 % 10th through 32nd — Less than 0,5 %		P
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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	Table 2 – Response to abnormal voltages Voltage (at point of utility connection) / Maximum trip time* V < 0,5 × Vnominal / 0,1 s 50 % ≤ V < 85 % / 2,0 s 85 % ≤ V ≤ 110 % / Continuous operation 110 % < V < 135 % / 2,0 s 135 % ≤ 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
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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4.3	TABLE: Flicker	P

Model: MAX 75KTL3-XL2

	Starting	Stopping	Running	
Limit	**4%**	**4%**	**Pst = 1.0**	**Plt = 0.65**
Test value L1-N	1.61	2.99	0.58	0.54
Test value L2-N	0.73	2.86	0.59	0.55
Test value L3-N	1.56	2.97	0.59	0.55

Supplementary information:

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: MAX 75KTL3-XL2									
196.9	25%	--	--	--	215.7	109.0	120.0	No	1969
196.9	50%	--	--	--	152.4	129.9	109.7	No	1969
196.9	100%	--	--	--	582.2	565.3	517.7	No	1969
Model: MAX 50KTL3-XL2									
131.2	25%	--	--	--	486.6	543.9	607.8	No	1312
131.2	50%	--	--	--	497.2	458.9	442.7	No	1312
131.2	100%	--	--	--	535.9	523.3	473.4	No	1312

Supplementary information:

4.6	TABLE: Harmonics and waveform distortion						P
Model: MAX 75KTL3-XL2							
Harmonic	**fundamental L1 (A)**	**% of fundamental)**	**fundamental L2 (A)**	**% of fundamental)**	**fundamental L3 (A)**	**% of fundamental)**	**Harmonic Current Limits (%)**
02	0.2266	0.1150	0.3814	0.1950	0.1367	0.0700	1.0%
03	0.1721	0.0870	0.2336	0.1190	0.0611	0.0310	4.0%

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04	0.0808	0.0410	0.2005	0.1020	0.1947	0.0990	1.0%
05	3.2068	1.6260	3.3086	1.6870	3.1664	1.6140	4.0%
06	0.0604	0.0310	0.1152	0.0590	0.0354	0.0180	1.0%
07	1.4608	0.7410	1.5422	0.7870	1.3969	0.7120	4.0%
08	0.1153	0.0580	0.1279	0.0650	0.0400	0.0200	1.0%
09	0.0739	0.0370	0.0337	0.0170	0.0909	0.0460	4.0%
10	0.1132	0.0570	0.1368	0.0700	0.1026	0.0520	0.5%
11	0.9060	0.4590	0.8268	0.4220	0.7467	0.3810	2.0%
12	0.0852	0.0430	0.0994	0.0510	0.0952	0.0490	0.5%
13	0.8945	0.4530	0.9354	0.4770	0.9098	0.4640	2.0%
14	0.0512	0.0260	0.0207	0.0110	0.0606	0.0310	0.5%
15	0.0663	0.0340	0.1000	0.0510	0.0634	0.0320	2.0%
16	0.1032	0.0520	0.0936	0.0480	0.1050	0.0540	0.5%
17	0.7812	0.3960	0.7098	0.3620	0.6849	0.3490	1.5%
18	0.0544	0.0280	0.0094	0.0050	0.0707	0.0360	0.5%
19	0.2055	0.1040	0.2316	0.1180	0.2439	0.1240	1.5%
20	0.0586	0.0300	0.0806	0.0410	0.0215	0.0110	0.5%
21	0.0418	0.0210	0.0337	0.0170	0.0346	0.0180	1.5%
22	0.0145	0.0070	0.0337	0.0170	0.0080	0.0040	0.5%
23	0.3791	0.1920	0.3900	0.1990	0.3871	0.1970	0.6%
24	0.0016	0.0010	0.0067	0.0030	0.0073	0.0040	0.5%
25	0.0967	0.0490	0.0858	0.0440	0.0925	0.0470	0.6%
26	0.0475	0.0240	0.0413	0.0210	0.0308	0.0160	0.5%
27	0.0184	0.0090	0.0134	0.0070	0.0085	0.0040	0.6%
28	0.0467	0.0240	0.0219	0.0110	0.0285	0.0150	0.5%
29	0.0642	0.0330	0.0830	0.0420	0.0721	0.0370	0.6%
30	0.0283	0.0140	0.0387	0.0200	0.0091	0.0050	0.5%
31	0.1072	0.0540	0.0982	0.0500	0.1058	0.0540	0.6%
32	0.0075	0.0040	0.0290	0.0150	0.0159	0.0080	0.5%
33	0.0407	0.0210	0.0262	0.0130	0.0203	0.0100	0.6%
THD	1.967		2.039		1.922		5%
Supplementary information:							

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4.6	TABLE: Harmonics and waveform distortion						P
Model: MAX 50KTL3-XL2							
Harmonic	**fundamental L1 (A)**	**% of fundamental)**	**fundamental L2 (A)**	**% of fundamental)**	**fundamental L3 (A)**	**% of fundamental)**	**Harmonic Current Limits (%)**
02	0.1085	0.0820	0.2345	0.1790	0.1366	0.1040	1.0%
03	0.0724	0.0550	0.1052	0.0800	0.0461	0.0350	4.0%
04	0.0952	0.0720	0.1341	0.1020	0.1260	0.0960	1.0%
05	1.4840	1.1230	1.5372	1.1700	1.4581	1.1090	4.0%
06	0.0435	0.0330	0.0754	0.0570	0.0588	0.0450	1.0%
07	0.8371	0.6330	0.9378	0.7140	0.8570	0.6520	4.0%
08	0.0433	0.0330	0.0692	0.0530	0.0332	0.0250	1.0%
09	0.0361	0.0270	0.0271	0.0210	0.0675	0.0510	4.0%
10	0.0115	0.0090	0.0566	0.0430	0.0654	0.0500	0.5%
11	0.5575	0.4220	0.5276	0.4020	0.4949	0.3770	2.0%
12	0.0673	0.0510	0.0855	0.0650	0.0683	0.0520	0.5%
13	0.4533	0.3430	0.4605	0.3510	0.4722	0.3590	2.0%
14	0.0546	0.0410	0.0302	0.0230	0.0387	0.0290	0.5%
15	0.0280	0.0210	0.0137	0.0100	0.0343	0.0260	2.0%
16	0.0411	0.0310	0.0446	0.0340	0.0077	0.0060	0.5%
17	0.6799	0.5140	0.6253	0.4760	0.6337	0.4820	1.5%
18	0.0280	0.0210	0.0309	0.0240	0.0342	0.0260	0.5%
19	0.1276	0.0970	0.1231	0.0940	0.1045	0.0800	1.5%
20	0.0406	0.0310	0.0573	0.0440	0.0133	0.0100	0.5%
21	0.0252	0.0190	0.0189	0.0140	0.0069	0.0050	1.5%
22	0.0167	0.0130	0.0219	0.0170	0.0280	0.0210	0.5%
23	0.2891	0.2190	0.2797	0.2130	0.2477	0.1880	0.6%
24	0.0251	0.0190	0.0264	0.0200	0.0378	0.0290	0.5%
25	0.0961	0.0730	0.1082	0.0820	0.0522	0.0400	0.6%
26	0.0131	0.0100	0.0431	0.0330	0.0266	0.0200	0.5%
27	0.0304	0.0230	0.0084	0.0060	0.0198	0.0150	0.6%
28	0.0420	0.0320	0.0503	0.0380	0.0717	0.0550	0.5%
29	0.0451	0.0340	0.0461	0.0350	0.0670	0.0510	0.6%

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30	0.0197	0.0150	0.0246	0.0190	0.0189	0.0140	0.5%
31	0.0624	0.0470	0.1120	0.0850	0.0753	0.0570	0.6%
32	0.0039	0.0030	0.0193	0.0150	0.0355	0.0270	0.5%
33	0.0189	0.0140	0.0162	0.0120	0.0378	0.0290	0.6%
THD	1.530		1.596		1.507		5%
Supplementary information:							

4.7	TABLE: Power factor							P
Model: MAX 75KTL3-XL2								
	Input			Output				
No	Voltage (V d.c.)	Current (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	Rated output (V.A)
1	362.38	44.59	16155.43	126.32	40.16	15163.87	0.9963	(20±5)%
2	362.15	66.08	23929.70	126.51	60.00	22707.25	0.9972	(30±5)%
3	361.78	87.82	31769.51	126.70	79.81	30263.72	0.9977	(40±5)%
4	127.04	99.78	12650.93	126.88	99.40	37755.57	0.9979	(50±5)%
5	361.15	131.34	47431.11	127.07	118.83	45212.32	0.9981	(60±5)%
6	360.94	153.26	55315.67	127.26	138.35	52717.43	0.9981	(70±5)%
7	360.57	175.43	63254.93	127.44	157.83	60225.20	0.9980	(80±5)%
8	360.26	197.81	71260.83	127.64	177.29	67762.75	0.9982	(90±5)%
9	360.00	220.18	79262.55	127.84	196.57	75255.32	0.9982	(100±5)%
Supplementary information: Power factor with “+” indicating leading and “-“ indicating lagging.								

4.7	TABLE: Power factor							P
Model: MAX 50KTL3-XL2								
	Input			Output				
No	Voltage (V d.c.)	Current (A d.c.)	Power (W)	Voltage (V a.c.)	Current (A a.c.)	Power (W)	Power factor (+/-)	Rated output (V.A)
1	362.62	29.90	10841.99	126.19	26.54	9994.20	0.9947	(20±5)%
2	362.38	44.33	16063.72	126.33	39.93	15079.91	0.9965	(30±5)%

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3	362.19	58.82	21304.75	126.45	53.11	20088.39	0.9970	(40±5)%
4	361.95	73.20	26493.21	126.58	66.31	25113.15	0.9974	(50±5)%
5	361.76	87.67	31715.18	126.71	79.46	30135.95	0.9977	(60±5)%
6	361.62	102.15	36939.44	126.84	92.61	35160.84	0.9978	(70±5)%
7	361.43	116.69	42175.56	126.97	105.70	40180.35	0.9979	(80±5)%
8	361.24	131.35	47446.70	126.89	119.01	45215.89	0.9981	(90±5)%
9	361.01	145.54	52541.17	127.01	131.64	50063.54	0.9982	(100±5)%

Supplementary information:
Power factor with “+” indicating leading and “-“ indicating lagging.

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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)
127	75K	107.95	108.0	0.10	4	106.98	1.49
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)
127	75K	63.5	63.0	0.10	0.1	63.90	0.063

(2) Under voltage reconnection procedure

Ratio of voltage rapidly decreased (V / s)	Reconnection voltage (V)	Reconnection time (s)
0.10	>108	81.2

(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)
127	75K	139.7	140	0.10	4	139.7	1.50
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)
127	75K	171.5	172	0.10	0.1	172.2	0.032

(4) Over voltage reconnection procedure

Ratio of voltage rapidly decreased (V / s)	Reconnection voltage (V)	Reconnection time (s)
0.10	<139	80.90

Supplementary information:
Tested on model MAX 75KTL3-XL2

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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	75K	59	59	0.01	0.3	59.01	0.185

(2) Under frequency reconnection procedure

Ratio of frequency rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
0.01	>59	82.2

(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	75K	61	61	0.01	0.3	60.96	0.182

(4) Over frequency reconnection procedure

Ratio of frequency rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
0.01	<61	80.8

Supplementary information:
Tested on model MAX 75KTL3-XL2 with frequency 60Hz

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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	75K	49	49	0.01	0.3	49.01	0.176

(2) Under frequency reconnection procedure

Ratio of frequency rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
0.01	>49	79.0

(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	75K	51	51	0.01	0.3	50.99	0.193

(4) Over frequency reconnection procedure

Ratio of frequency rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
0.01	<51	79.0

Supplementary information:
Tested on model MAX 75KTL3-XL2 with frequency 50Hz

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Cl.	Requirement - Test	Result	Verdict

5.3	TABLE: tested condition and run-on time	P

Model: Tested on model MAX 75KTL3-XL2 with frequency 50Hz

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	459.5	75.11	1.00	800	/
2	100	100	-5	-5	332.5	75.11	0.98	800	/
3	100	100	-5	0	279.5	75.11	0.95	800	/
4	100	100	-5	+5	305.0	75.11	0.93	800	/
5	100	100	0	-5	401.0	75.11	1.03	800	/
6	100	100	0	+5	311.5	75.11	0.98	800	/
7	100	100	+5	-5	258.5	75.11	1.08	800	/
8	100	100	+5	0	279.5	75.11	1.06	800	/
9	100	100	+5	+5	157.5	75.11	1.03	800	/
Test condition B									
10	66	66	0	0	299.5	49.68	1.00	520	/
11	66	66	0	-5	196.0	49.68	1.03	520	L
12	66	66	0	-4	292.0	49.68	1.02	520	L
13	66	66	0	-3	287.5	49.68	1.02	520	L
14	66	66	0	-2	243.5	49.68	1.01	520	L
15	66	66	0	-1	242.0	49.68	1.01	520	L
16	66	66	0	1	308.0	49.68	0.99	520	L
17	66	66	0	2	464.0	49.68	0.99	520	L
18	66	66	0	3	415.5	49.68	0.98	520	L
19	66	66	0	4	409.5	49.68	0.98	520	L
20	66	66	0	5	311.5	49.68	0.97	520	L
Test condition C									
21	33	33	0	0	838.0	24.81	1.00	309	/
22	33	33	0	-5	529.0	24.81	1.03	309	L
23	33	33	0	-4	668.0	24.81	1.02	309	L
24	33	33	0	-3	832.0	24.81	1.02	309	L
25	33	33	0	-2	652.0	24.81	1.01	309	L
26	33	33	0	-1	770.0	24.81	1.01	309	L
27	33	33	0	1	716.0	24.81	0.99	309	L
28	33	33	0	2	600.0	24.81	0.99	309	L
29	33	33	0	3	858.0	24.81	0.98	309	L
30	33	33	0	4	612.0	24.81	0.98	309	L
31	33	33	0	5	460.0	24.81	0.97	309	L

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Cl.	Requirement - Test	Result	Verdict

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.

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Cl.	Requirement - Test	Result	Verdict

5.3	TABLE: tested condition and run-on time	P

Model: Tested on model MAX 75KTL3-XL2 with frequency 60Hz

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	730.0	75.11	1.00	800	/
2	100	100	-5	-5	330.0	75.11	0.97	800	/
3	100	100	-5	0	484.0	75.11	0.95	800	/
4	100	100	-5	+5	414.0	75.11	0.93	800	/
5	100	100	0	-5	322.0	75.11	1.03	800	/
6	100	100	0	+5	256.0	75.11	0.98	800	/
7	100	100	+5	-5	260.0	75.11	1.08	800	/
8	100	100	+5	0	648.0	75.11	1.06	800	/
9	100	100	+5	+5	588.0	75.11	1.04	800	/
Test condition B									
10	66	66	0	0	335.5	49.68	1.00	520	/
11	66	66	0	-5	259.0	49.68	1.03	520	L
12	66	66	0	-4	327.0	49.68	1.02	520	L
13	66	66	0	-3	373.5	49.68	1.02	520	L
14	66	66	0	-2	327.5	49.68	1.01	520	L
15	66	66	0	-1	285.5	49.68	1.01	520	L
16	66	66	0	1	313.0	49.68	0.99	520	L
17	66	66	0	2	629.0	49.68	0.99	520	L
18	66	66	0	3	327.0	49.68	0.98	520	L
19	66	66	0	4	411.0	49.68	0.98	520	L
20	66	66	0	5	299.0	49.68	0.97	520	L
Test condition C									
21	33	33	0	0	530.0	24.81	1.00	309	/
22	33	33	0	-5	134.5	24.81	1.03	309	L
23	33	33	0	-4	192.5	24.81	1.02	309	L
24	33	33	0	-3	178.5	24.81	1.02	309	L
25	33	33	0	-2	226.5	24.81	1.01	309	L
26	33	33	0	-1	234.5	24.81	1.01	309	L
27	33	33	0	1	235.5	24.81	0.99	309	L
28	33	33	0	2	153.5	24.81	0.99	309	L
29	33	33	0	3	182.5	24.81	0.98	309	L
30	33	33	0	4	176.5	24.81	0.98	309	L
31	33	33	0	5	175.5	24.81	0.97	309	L

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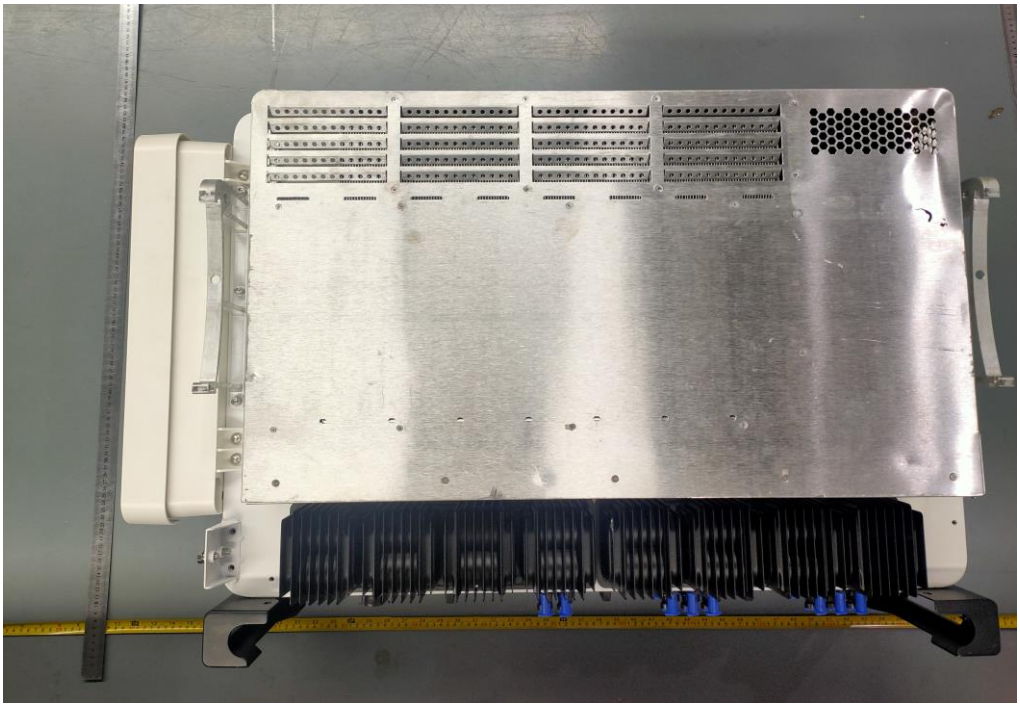
Cl.	Requirement - Test	Result	Verdict

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

Top view of the unit



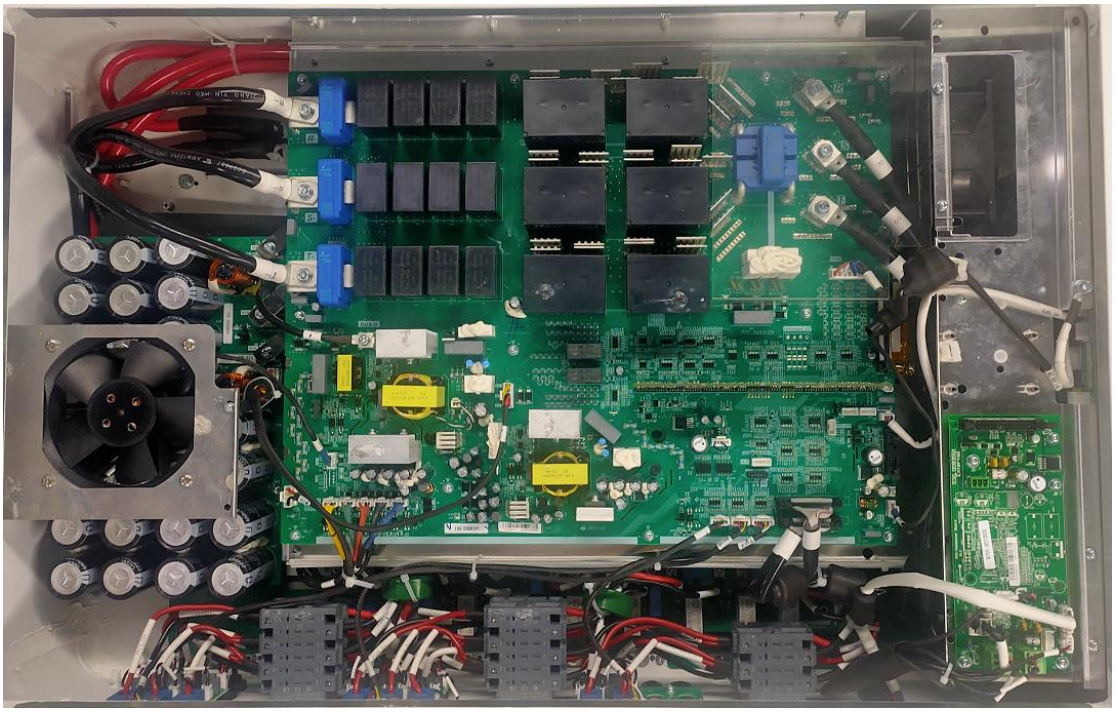
Back view of the unit

Appendix 1: Photos

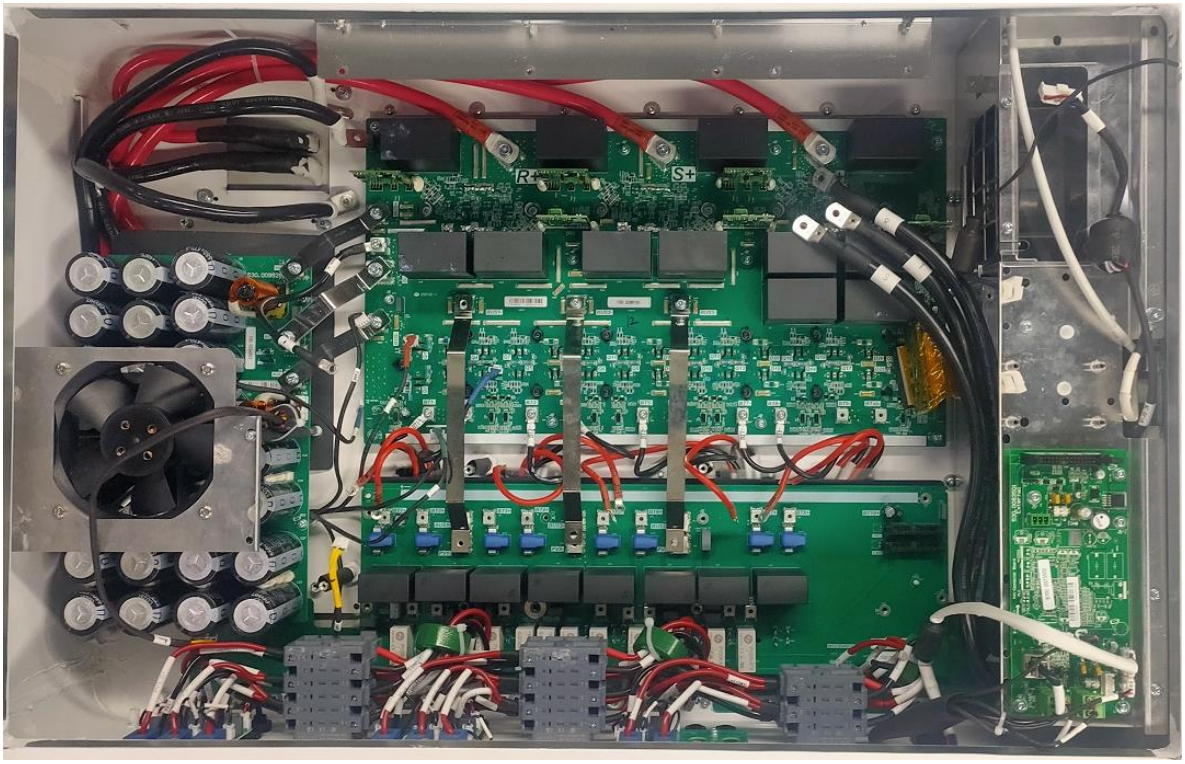
PV Input Terminal view

Side view

Appendix 1: Photos



Internal view



Internal view

--- End of test report---