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

**Report Number**..... : 200427174GZU-001

**Date of issue**..... : 20 Jul 2020

**Total number of pages** ..... 29 Pages

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Guangzhou, Guangdong, China

**Applicant's name** ..... Shenzhen Growatt New Energy Technology CO., Ltd  
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Street, Baoan District, Shenzhen, P.R.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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**General disclaimer:**

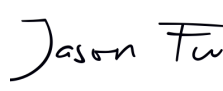
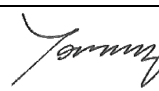
The test results presented in this report relate only to the object tested.

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<b>Test item description . :</b>	PV Grid inverter				
<b>Trade Mark .....</b>	Growatt				
<b>Manufacturer.....</b>	Same as applicant				
<b>Model/Type reference :</b>	MOD 3000TL3-X, MOD 4000TL3-X, MOD 5000TL3-X, MOD 6000TL3-X, MOD 7000TL3-X, MOD 8000TL3-X, MOD 9000TL3-X, MOD 10KTL3-X, MOD 11KTL3-X, MOD 12KTL3-X, MOD 13KTL3-X, MOD 15KTL3-X				
<b>Ratings .....</b>	Model	MOD 3000TL3-X	MOD 4000TL3-X	MOD 5000TL3-X	MOD 6000TL3-X
	Max. PV voltage	1100Vdc			
	PV voltage range	140 – 1000Vdc			
	PV Isc	2*16A			
	Max. input current	2*13A			
	Max. output power	3000W	4000W	5000W	6000W
	Max. apparent power	3300VA	4400VA	5500VA	6600VA
	Nominal output voltage	3W/N/PE 230/400Vac			
	Max. output current	5.0A	6.7A	8.3A	10.0A
	Nominal output frequency	50/60Hz			
	Power factor range	0.8Leading ~ 0.8Lagging			
	Safety level	Class I			
	Ingress protection	IP66			
	Operation ambient temperature	-25°C - +60°C			
	Software version	DL 1.0			
	Model	MOD 7000TL3-X	MOD 8000TL3-X	MOD 9000TL3-X	MOD 10KTL3-X
	Max. PV	1100Vdc			

voltage				
PV voltage range	140 – 1000Vdc			
PV Isc	2*16A			
Max. input current	2*13A			
Max. output power	7000W	8000W	9000W	10000W
Max. apparent power	7700VA	8800VA	9900VA	11000VA
Nominal output voltage	3W/N/PE 230/400Vac			
Max. output current	11.7A	13.3A	15.0A	16.7A
Nominal output frequency	50/60Hz			
Power factor range	0.8Leading ~ 0.8Lagging			
Safety level	Class I			
Ingress protection	IP66			
Operation ambient temperature	-25°C - +60°C			
Software version	DL 1.0			
Model	MOD 11KTL3-X	MOD 12KTL3-X	MOD 13KTL3-X	MOD 15KTL3-X
Max. PV voltage	1100Vdc			
PV voltage range	140 – 1000Vdc			
PV Isc	2*16A	16/32A		
Max. input current	2*13A	13/26A		
Max. output power	11000W	12000W	13000W	15000W
Max. apparent	12100VA	13200VA	14300VA	16500VA



power				
Nominal output voltage	3W/N/PE 230/400Vac			
Max. output current	18.3A	20.0A	21.7A	25.0A
Nominal output frequency	50/60Hz			
Power factor range	0.8Leading ~ 0.8Lagging			
Safety level	Class I			
Ingress protection	IP66			
Operation ambient temperature	-25°C - +60°C			
Software version	DL 1.0			

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	<b>Testing Laboratory:</b>	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
<b>Testing location/ address.....:</b>		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
<input type="checkbox"/>	<b>Associated CB Testing Laboratory:</b>	N/A
<b>Testing location/ address.....:</b>		N/A
<b>Tested by (name, function, signature).....:</b>		Jason Fu Technical Team Leader 
<b>Approved by (name, function, signature)....:</b>		Tommy Zhong Technical Manager 
<hr/>		
<input type="checkbox"/>	<b>Testing procedure: TMP/CTF Stage 1:</b>	N/A
<b>Testing location/ address.....:</b>		N/A
<b>Tested by (name, function, signature).....:</b>		N/A
<b>Approved by (name, function, signature)....:</b>		N/A
<hr/>		
<input type="checkbox"/>	<b>Testing procedure: WMT/CTF Stage 2:</b>	N/A
<b>Testing location/ address.....:</b>		N/A
<b>Tested by (name + signature) .....</b>		N/A
<b>Witnessed by (name, function, signature) .:</b>		N/A
<b>Approved by (name, function, signature)....:</b>		N/A
<hr/>		
<input type="checkbox"/>	<b>Testing procedure: SMT/CTF Stage 3 or 4:</b>	N/A
<b>Testing location/ address.....:</b>		N/A
<b>Tested by (name, function, signature).....:</b>		N/A
<b>Witnessed by (name, function, signature) .:</b>		N/A
<b>Approved by (name, function, signature)....:</b>		N/A
<b>Supervised by (name, function, signature) :</b>		N/A

<p><b>List of Attachments (including a total number of pages in each attachment):</b>  <b>Appendix 1: photos (4 pages)</b></p>	
<p><b>Summary of testing:</b></p>	
<p><b>Tests performed (name of test and test clause):</b>                  All applicable tests</p>	<p><b>Testing location:</b>                  Intertek Testing Services Shenzhen Ltd.                  Guangzhou Branch                  Room 02, &amp;                  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</p>
<p><b>Summary of compliance with National Differences:</b>  <b>List of countries addressed</b>                  N/A</p> <p><input checked="" type="checkbox"/> <b>The product fulfils the requirements of IEC 61727:2004</b></p>	

**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.

 <b>Growatt</b> PV Grid Inverter	
Model name	MOD 15KTL3-X
Max. PV voltage	1100 d.c.V
PV voltage range	140-1000 d.c.V
PV Isc	16/32 d.c.A
Max. input current	13/26 d.c.A
Max. output power	15000 W
Max. apparent power	16500 VA
Nominal output voltage	3W/N/PE 230/400 a.c.V
Max. output current	25.0 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	-25°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 name and ratings

<b>Test item particulars</b> .....:	
<b>Classification of installation and use</b> .....: Fixed and outdoor use	
<b>Supply Connection</b> .....: Permanent connection	
.....:	
<b>Possible test case verdicts:</b>	
- 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)	
<b>Testing</b> .....:	
<b>Date of receipt of test item</b> .....: 27 April 2020	
<b>Date (s) of performance of tests</b> .....: 27 April 2020 to 18 Jun 2020	
<b>General remarks:</b>	
<p>"(See Enclosure #)" refers to additional information appended to the report.          "(See appended table)" refers to a table appended to the report.  <b>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</b></p> <p>Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.</p> <p>This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.</p> <p>The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.</p> <p><b>This report shall be used together with the report 200427174GZU-002.</b></p>	
<b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC 61727B:</b>	
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 .....:	<input type="checkbox"/> <b>Yes</b> <input checked="" type="checkbox"/> <b>Not applicable</b>
<b>When differences exist; they shall be identified in the General product information section.</b>	



<b>Name and address of factory (ies) .....</b> : Shenzhen Growatt New Energy Technology CO.,Ltd 1st East & 3rd Floor of Building A, Building B, Jiayu Industrial Park, #28, GuangHui Road, LongTeng Community, Shiyan Street, Baoan District, Shenzhen, P.R.China
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**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 EMI filtering at the PV side and AC side. It is transformerless between the PV circuit and AC circuit.

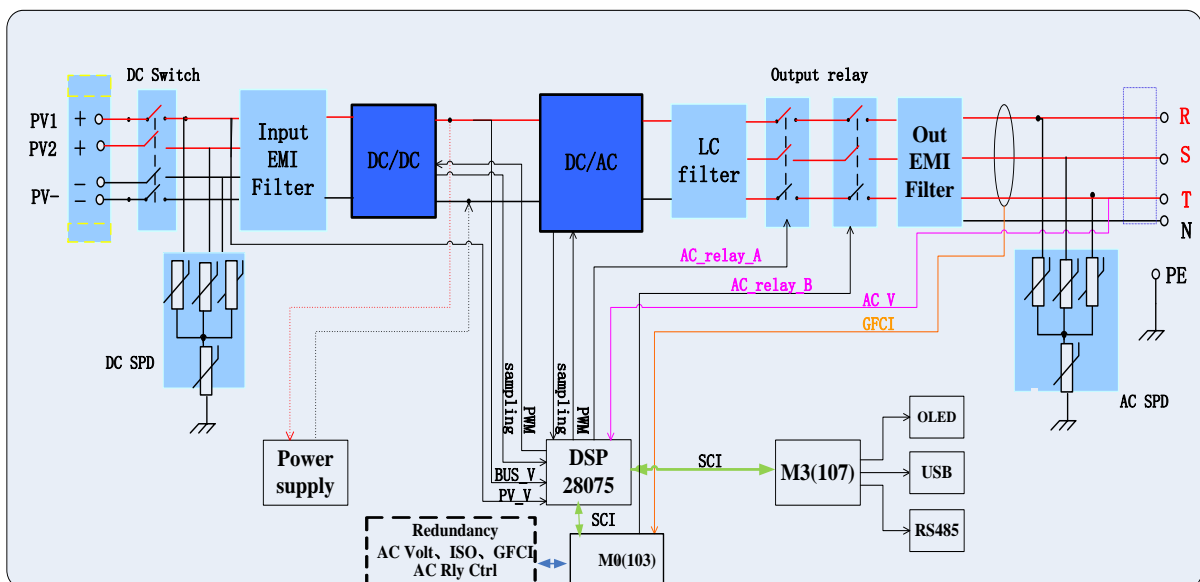
The unit has two controllers. The master controller DSP monitor the invert statue; measure the PV voltage and current, bus voltage, AC voltage, current, GFCI and frequency, also communicate with the slave controller MCU

The slave controller MCU monitor AC voltage, current, frequency, GFCI , PV ISO and communicate with the master controller DSP

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

The master controller and slave controller 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 rating of same components (IGBT, Boost chock, INV chock etc) are different and the output power is derating in software.

Other than special notes, typical model MOD 15KTL3-X used as representative for testing in this report.

IEC61727			
Cl.	Requirement - Test	Result	Verdict
<b>4</b>	<b>UTILITY COMPATIBILITY</b>		<b>P</b>
	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
<b>4.1</b>	<b>Voltage, current and frequency</b>		<b>P</b>
	The PV system AC voltage, current and frequency are compatible with the utility system.		P
<b>4.2</b>	<b>Normal voltage operating range</b>		<b>P</b>
	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
<b>4.3</b>	<b>Flicker</b>		<b>P</b>
	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
<b>4.4</b>	<b>DC injection</b>		<b>P</b>
	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
<b>4.5</b>	<b>Normal frequency operating range</b>		<b>P</b>
	The PV system operates in synchronism with the utility system, and within the frequency trip limits defined in 5.2.2.		P
<b>4.6</b>	<b>Harmonics and waveform distortion</b>		<b>P</b>
	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

IEC61727																			
Cl.	Requirement - Test	Result	Verdict																
	<p align="center"><b>Table 1 – Current distortion limits</b></p> <table border="1"> <thead> <tr> <th>Odd harmonics</th> <th>Distortion limit</th> </tr> </thead> <tbody> <tr> <td>3<sup>rd</sup> through 9<sup>th</sup></td> <td>Less than 4,0 %</td> </tr> <tr> <td>11<sup>th</sup> through 15<sup>th</sup></td> <td>Less than 2,0 %</td> </tr> <tr> <td>17<sup>th</sup> through 21<sup>st</sup></td> <td>Less than 1,5 %</td> </tr> <tr> <td>23<sup>rd</sup> through 33<sup>rd</sup></td> <td>Less than 0,6 %</td> </tr> <tr> <th>Even harmonics</th> <th>Distortion limit</th> </tr> <tr> <td>2<sup>rd</sup> through 8<sup>th</sup></td> <td>Less than 1,0 %</td> </tr> <tr> <td>10<sup>th</sup> through 32<sup>nd</sup></td> <td>Less than 0,5 %</td> </tr> </tbody> </table>	Odd harmonics	Distortion limit	3 <sup>rd</sup> through 9 <sup>th</sup>	Less than 4,0 %	11 <sup>th</sup> through 15 <sup>th</sup>	Less than 2,0 %	17 <sup>th</sup> through 21 <sup>st</sup>	Less than 1,5 %	23 <sup>rd</sup> through 33 <sup>rd</sup>	Less than 0,6 %	Even harmonics	Distortion limit	2 <sup>rd</sup> through 8 <sup>th</sup>	Less than 1,0 %	10 <sup>th</sup> through 32 <sup>nd</sup>	Less than 0,5 %		P
Odd harmonics	Distortion limit																		
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10 <sup>th</sup> through 32 <sup>nd</sup>	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																
<b>5</b>	<b>PERSONNEL SAFETY AND EQUIPMENT PROTECTION</b>		<b>P</b>																
	This Clause provides information and considerations for the safe and proper operation of the utility-connected PV systems.		P																
<b>5.1</b>	<b>Loss of utility voltage</b>		<b>P</b>																
	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																
<b>5.2</b>	<b>Over/under voltage and frequency</b>		<b>P</b>																
	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																
<b>5.2.1</b>	<b>Over/under voltage</b>		<b>P</b>																
	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																

IEC61727															
Cl.	Requirement - Test	Result	Verdict												
	<p align="center"><b>Table 2 – Response to abnormal voltages</b></p> <table border="1"> <thead> <tr> <th>Voltage (at point of utility connection)</th> <th>Maximum trip time*</th> </tr> </thead> <tbody> <tr> <td><math>V &lt; 0,5 \times V_{nominal}</math></td> <td>0,1 s</td> </tr> <tr> <td><math>50 \% \leq V &lt; 85 \%</math></td> <td>2,0 s</td> </tr> <tr> <td><math>85 \% \leq V \leq 110 \%</math></td> <td>Continuous operation</td> </tr> <tr> <td><math>110 \% &lt; V &lt; 135 \%</math></td> <td>2,0 s</td> </tr> <tr> <td><math>135 \% \leq V</math></td> <td>0,05 s</td> </tr> </tbody> </table> <p>* 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>	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		P
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														
<b>5.2.2</b>	<b>Over/under frequency</b>		<b>P</b>												
	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 $\pm 1$ 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												
<b>5.3</b>	<b>Islanding protection</b>		<b>P</b>												
	The PV system must cease to energize the utility line within 2 s of loss of utility.		P												
<b>5.4</b>	<b>Response to utility recovery</b>		<b>P</b>												
	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												
<b>5.5</b>	<b>Earthing</b>		<b>P</b>												
	The utility interface equipment is earthed/grounded in accordance with IEC 60364-7-712.		P												
<b>5.6</b>	<b>Short circuit protection</b>		<b>N/A</b>												
	The photovoltaic system has short-circuit protection in accordance with IEC 60364-7-712.	Should consider in the end use	N/A												
<b>5.7</b>	<b>Isolation and switching</b>		<b>N/A</b>												
	A method of isolation and switching is provided in accordance with IEC 60364-7-712.	Should consider in the end use	N/A												

IEC61727			
Cl.	Requirement - Test	Result	Verdict

<b>4.3</b>	<b>TABLE: Flicker</b>				<b>P</b>
Model: MOD 15KTL3-X					
	<b>Starting</b>	<b>Stopping</b>	<b>Running</b>		
<b>Limit</b>	<b>4%</b>	<b>4%</b>	<b>Pst = 1.0</b>	<b>Plt = 0.65</b>	
Test value L1-N	1.13	1.13	0.26	0.20	
Test value L2-N	2.32	2.32	0.39	0.32	
Test value L3-N	0.99	0.99	0.28	0.22	
Model: MOD 3000TL3-X					
	<b>Starting</b>	<b>Stopping</b>	<b>Running</b>		
<b>Limit</b>	<b>4%</b>	<b>4%</b>	<b>Pst = 1.0</b>	<b>Plt = 0.65</b>	
Test value L1-N	0.00	0.00	0.40	0.29	
Test value L2-N	0.00	0.00	0.36	0.19	
Test value L3-N	0.00	0.00	0.38	0.26	
Supplementary information:					

<b>4.4</b>	<b>TABLE: Direct current injection</b>							<b>P</b>	
<b>Rated output current (A)</b>	<b>Ratio of rated output power (VA)</b>	<b>Measured DC output current between terminals</b>						<b>Isolated transformer ? (Yes/No)</b>	<b>Limit (mA)</b>
		<b>L1-L2 (mA)</b>	<b>L1-L3 (mA)</b>	<b>L2-L3 (mA)</b>	<b>L1-N (mA)</b>	<b>L2-N (mA)</b>	<b>L3-N (mA)</b>		
Model: MOD 3000TL3-X									
4.35	25%	--	--	--	16.3	11.9	19.4	No	43.5
4.35	50%	--	--	--	13.8	7.6	17.9	No	43.5
4.35	100%	--	--	--	12.8	18.8	21.7	No	43.5
Model: MOD 15KTL3-X									
21.74	25%	--	--	--	42.4	40.2	28.4	No	217.4
21.74	50%	--	--	--	47.5	45.9	22.8	No	217.4
21.74	100%	--	--	--	79.4	66.7	32.6	No	217.4
Supplementary information:									

IEC61727			
Cl.	Requirement - Test	Result	Verdict

4.6	TABLE: Harmonics and waveform distortion							P
Model: MOD 3000TL3-X								
Harmonic	fundamental L1 (A)	% of fundamental	fundamental L2 (A)	% of fundamental	fundamental L3 (A)	% of fundamental	Harmonic Current Limits (%)	
02	0.0124	0.2797	0.0074	0.1653	0.0121	0.2718	1.0%	
03	0.0056	0.1259	0.0049	0.1101	0.0075	0.1679	4.0%	
04	0.0011	0.0257	0.0076	0.1704	0.0073	0.1643	1.0%	
05	0.0301	0.6778	0.0248	0.5562	0.0273	0.6137	4.0%	
06	0.0026	0.0576	0.0021	0.0470	0.0045	0.1009	1.0%	
07	0.0266	0.5987	0.0271	0.6098	0.0256	0.5741	4.0%	
08	0.0024	0.0533	0.0026	0.0583	0.0037	0.0832	1.0%	
09	0.0012	0.0274	0.0033	0.0749	0.0024	0.0536	4.0%	
10	0.0034	0.0774	0.0047	0.1064	0.0049	0.1101	0.5%	
11	0.0333	0.7512	0.0326	0.7323	0.0359	0.8068	2.0%	
12	0.0029	0.0657	0.0018	0.0412	0.0019	0.0436	0.5%	
13	0.0256	0.5771	0.0292	0.6569	0.0299	0.6712	2.0%	
14	0.0022	0.0502	0.0046	0.1026	0.0052	0.1178	0.5%	
15	0.0012	0.0275	0.0025	0.0563	0.0030	0.0670	2.0%	
16	0.0027	0.0599	0.0038	0.0849	0.0032	0.0727	0.5%	
17	0.0221	0.4977	0.0202	0.4547	0.0237	0.5327	1.5%	
18	0.0018	0.0404	0.0009	0.0210	0.0014	0.0304	0.5%	
19	0.0179	0.4026	0.0219	0.4917	0.0186	0.4170	1.5%	
20	0.0014	0.0305	0.0028	0.0634	0.0040	0.0893	0.5%	
21	0.0010	0.0223	0.0010	0.0225	0.0010	0.0220	1.5%	
22	0.0016	0.0350	0.0021	0.0465	0.0017	0.0392	0.5%	
23	0.0183	0.4130	0.0137	0.3082	0.0159	0.3561	0.6%	
24	0.0011	0.0256	0.0008	0.0181	0.0012	0.0269	0.5%	
25	0.0057	0.1276	0.0037	0.0828	0.0048	0.1077	0.6%	
26	0.0015	0.0338	0.0015	0.0329	0.0024	0.0533	0.5%	
27	0.0035	0.0791	0.0020	0.0459	0.0049	0.1100	0.6%	
28	0.0013	0.0286	0.0008	0.0188	0.0010	0.0223	0.5%	
29	0.0036	0.0805	0.0025	0.0551	0.0051	0.1151	0.6%	

IEC61727							
Cl.	Requirement - Test				Result		Verdict
30	0.0014	0.0317	0.0007	0.0169	0.0015	0.0333	0.5%
31	0.0089	0.2004	0.0099	0.2232	0.0041	0.0915	0.6%
32	0.0014	0.0319	0.0011	0.0239	0.0010	0.0229	0.5%
33	0.0023	0.0528	0.0030	0.0676	0.0043	0.0970	0.6%
THD	1.715%		1.691%		1.772%		5%
Model: MOD 15KTL3-X							
Harmonic	fundamental L1 (A)	% of fundamental	fundamental L2 (A)	% of fundamental	fundamental L3 (A)	% of fundamental	Harmonic Current Limits (%)
02	0.0737	0.3324	0.0481	0.2165	0.0596	0.2679	1.0%
03	0.0255	0.1152	0.0211	0.0950	0.0300	0.1349	4.0%
04	0.0080	0.0360	0.0432	0.1944	0.0392	0.1764	1.0%
05	0.1589	0.7172	0.1353	0.6089	0.1468	0.6599	4.0%
06	0.0119	0.0535	0.0099	0.0443	0.0200	0.0898	1.0%
07	0.1425	0.6429	0.1444	0.6500	0.1384	0.6220	4.0%
08	0.0136	0.0615	0.0145	0.0653	0.0197	0.0884	1.0%
09	0.0057	0.0259	0.0169	0.0762	0.0118	0.0530	4.0%
10	0.0167	0.0754	0.0247	0.1111	0.0239	0.1072	0.5%
11	0.1741	0.7858	0.1709	0.7692	0.1881	0.8456	2.0%
12	0.0148	0.0668	0.0095	0.0425	0.0081	0.0366	0.5%
13	0.1339	0.6042	0.1513	0.6808	0.1547	0.6954	2.0%
14	0.0130	0.0585	0.0248	0.1117	0.0276	0.1242	0.5%
15	0.0060	0.0272	0.0127	0.0571	0.0148	0.0665	2.0%
16	0.0145	0.0652	0.0201	0.0903	0.0170	0.0766	0.5%
17	0.1130	0.5097	0.1046	0.4705	0.1214	0.5460	1.5%
18	0.0096	0.0434	0.0047	0.0212	0.0076	0.0340	0.5%
19	0.0912	0.4118	0.1105	0.4974	0.0948	0.4263	1.5%
20	0.0074	0.0334	0.0150	0.0676	0.0216	0.0973	0.5%
21	0.0057	0.0256	0.0059	0.0264	0.0050	0.0225	1.5%
22	0.0080	0.0361	0.0103	0.0462	0.0091	0.0408	0.5%
23	0.0937	0.4229	0.0697	0.3138	0.0798	0.3586	0.6%
24	0.0059	0.0264	0.0040	0.0178	0.0059	0.0263	0.5%
25	0.0278	0.1255	0.0170	0.0763	0.0244	0.1099	0.6%



IEC61727							
Cl.	Requirement - Test				Result		Verdict
26	0.0079	0.0358	0.0064	0.0288	0.0115	0.0517	0.5%
27	0.0177	0.0798	0.0105	0.0473	0.0242	0.1089	0.6%
28	0.0057	0.0256	0.0039	0.0176	0.0051	0.0230	0.5%
29	0.0185	0.0834	0.0133	0.0600	0.0267	0.1199	0.6%
30	0.0070	0.0316	0.0036	0.0162	0.0080	0.0358	0.5%
31	0.0450	0.2032	0.0489	0.2202	0.0201	0.0905	0.6%
32	0.0069	0.0313	0.0047	0.0212	0.0051	0.0230	0.5%
33	0.0125	0.0566	0.0156	0.0700	0.0225	0.1010	0.6%
THD	1.815%		1.773%		1.834%		5%
Supplementary information:							

IEC61727			
Cl.	Requirement - Test	Result	Verdict

<b>4.7</b>	<b>TABLE: Power factor</b>	<b>P</b>
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Model: MOD 3000TL3-X

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	699.56	0.90	630.44	231.27	0.89	610.38	0.9935	(20±5)%
2	699.37	1.35	946.46	231.32	1.33	921.55	0.9960	(30±5)%
3	699.22	1.78	1242.81	231.37	1.78	1231.78	0.9971	(40±5)%
4	699.04	2.22	1553.96	231.42	2.18	1510.60	0.9976	(50±5)%
5	698.92	2.68	1874.38	231.47	2.63	1820.35	0.9979	(60±5)%
6	698.75	3.14	2193.95	231.52	3.07	2130.08	0.9980	(70±5)%
7	698.58	3.55	2478.18	231.57	3.52	2439.50	0.9981	(80±5)%
8	698.42	4.00	2794.95	231.62	3.96	2748.84	0.9981	(90±5)%
9	698.21	4.50	3141.36	231.67	4.45	3089.57	0.9982	(100±5)%

Model: MOD 15KTL3-X

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	699.51	4.52	3165.04	231.27	4.43	3051.97	0.9934	(20±5)%
2	699.28	6.77	4736.85	231.32	6.67	4607.37	0.9958	(30±5)%
3	699.14	8.80	6148.97	231.37	8.90	6158.42	0.9971	(40±5)%
4	698.99	11.08	7748.14	231.43	11.13	7708.02	0.9976	(50±5)%
5	698.87	13.37	9341.86	231.48	13.36	9255.93	0.9980	(60±5)%
6	698.71	15.61	10909.40	231.53	15.58	10803.91	0.9981	(70±5)%
7	698.59	17.65	12327.98	231.58	17.59	12197.32	0.9981	(80±5)%
8	698.42	19.89	13890.03	231.63	19.82	13745.52	0.9981	(90±5)%
9	698.27	22.38	15629.34	231.69	22.27	15448.87	0.9982	(100±5)%

Supplementary information:

Power factor with "+" indicating leading and "-" indicating lagging.

IEC61727			
Cl.	Requirement - Test	Result	Verdict

<b>5.2.1 &amp; 5.4</b>		<b>TABLE: Under-and over-voltage trip settings and reconnection test</b>						<b>P</b>
<b>(1) Under voltage disconnection procedure</b>								
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	15000	195.5	195.5	0.22	4	197.19	1.77	
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	15000	115	115	0.22	0.1	116.66	0.049	
<b>(2) Under voltage reconnection procedure</b>								
Ratio of voltage rapidly decreased (V / s)			Reconnection voltage (V)		Reconnection time (s)			
0.22			>195.5		80.0			
<b>(3) Over voltage disconnection procedure</b>								
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	15000	253	253	0.22	4	252.87	0.078	
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	15000	310.5	310.5	0.22	0.1	309.26	0.046	
<b>(4) Over voltage reconnection procedure</b>								
Ratio of voltage rapidly decreased (V / s)			Reconnection voltage (V)		Reconnection time (s)			
0.22			<253		78.0			
Supplementary information: Tested on model MOD 15KTL3-X								

IEC61727			
Cl.	Requirement - Test	Result	Verdict

<b>5.2.2 &amp; 5.4</b>		<b>TABLE: Over/under frequency trip settings and reconnection test</b>						<b>P</b>
<b>(1) Under frequency disconnection procedure</b>								
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	15000	59	59	0.01	0.3	58.99	0.028	
<b>(2) Under frequency reconnection procedure</b>								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			>59		72.0			
<b>(3) Over frequency disconnection procedure</b>								
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	15000	61	61	0.01	0.3	61.01	0.036	
<b>(4) Over frequency reconnection procedure</b>								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			<61		76.0			
Supplementary information:								
Tested on model MOD 15KTL3-X with frequency 60Hz								

IEC61727			
Cl.	Requirement - Test	Result	Verdict

<b>5.2.2 &amp; 5.4</b>		<b>TABLE: Over/under frequency trip settings and reconnection test</b>						<b>P</b>
<b>(1) Under frequency disconnection procedure</b>								
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	15000	49	49	0.01	0.3	48.99	0.11	
<b>(2) Under frequency reconnection procedure</b>								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			>49		78.0			
<b>(3) Over frequency disconnection procedure</b>								
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	15000	51	51	0.01	0.3	51.03	0.128	
<b>(4) Over frequency reconnection procedure</b>								
Ratio of frequency rapidly decreased (Hz / s)			Reconnection frequency (Hz)		Reconnection time (s)			
0.01			<51		76.0			
Supplementary information:								
Tested on model MOD 15KTL3-X with frequency 50Hz								

IEC61727

Cl.	Requirement - Test	Result	Verdict
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<b>5.3</b>	<b>TABLE: tested condition and run-on time</b>	<b>P</b>
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Model: Tested on model MOD 15KTL3-X with frequency 50Hz

No.	P <sub>EUT</sub> (% of EUT rating)	Reactive load (% of normal)	P <sub>AC</sub>	Q <sub>AC</sub>	Run-on time(ms)	P <sub>EUT</sub> (KW)	Actual Q <sub>f</sub> (Var)	V <sub>DC</sub> (V)	Which load is selected to be adjusted (R or L)
Test condition A									
1	100	100	0	0	602.0	15	1.00	850	/
2	100	100	-5	-5	272.0	15	1.01	850	/
3	100	100	-5	0	393.0	15	0.95	850	/
4	100	100	-5	+5	276.0	15	0.93	850	/
5	100	100	0	-5	291.0	15	1.03	850	/
6	100	100	0	+5	303.0	15	0.97	850	/
7	100	100	+5	-5	297.0	15	1.07	850	/
8	100	100	+5	0	353.0	15	1.05	850	/
9	100	100	+5	+5	330.0	15	1.02	850	/
Test condition B									
10	66	66	0	0	304.0	9.9	1.00	620	/
11	66	66	0	-5	202.0	9.9	1.02	620	L
12	66	66	0	-4	239.0	9.9	1.01	620	L
13	66	66	0	-3	248.0	9.9	1.01	620	L
14	66	66	0	-2	233.0	9.9	1.00	620	L
15	66	66	0	-1	283.0	9.9	0.99	620	L
16	66	66	0	1	340.0	9.9	0.99	620	L
17	66	66	0	2	348.0	9.9	0.98	620	L
18	66	66	0	3	337.0	9.9	0.97	620	L
19	66	66	0	4	249.0	9.9	0.97	620	L
20	66	66	0	5	241.0	9.9	0.97	620	L
Test condition C									
21	33	33	0	0	281.0	4.95	1.00	300	/
22	33	33	0	-5	166.0	4.95	1.02	300	L
23	33	33	0	-4	175.0	4.95	1.02	300	L
24	33	33	0	-3	164.0	4.95	1.02	300	L
25	33	33	0	-2	191.0	4.95	1.01	300	L
26	33	33	0	-1	186.0	4.95	1.01	300	L
27	33	33	0	1	180.0	4.95	1.00	300	L
28	33	33	0	2	232.0	4.95	0.99	300	L
29	33	33	0	3	244.0	4.95	0.99	300	L
30	33	33	0	4	287.0	4.95	0.98	300	L
31	33	33	0	5	210.0	4.95	0.98	300	L

IEC61727			
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.

IEC61727			
Cl.	Requirement - Test	Result	Verdict

5.3		TABLE: tested condition and run-on time								P
Model: Tested on model MOD 15KTL3-X with frequency 60Hz										
No.	P <sub>EUT</sub> (% of EUT rating)	Reactive load (% of normal)	P <sub>AC</sub>	Q <sub>AC</sub>	Run-on time(ms)	P <sub>EUT</sub> (KW)	Actual Q <sub>f</sub> (Var)	V <sub>DC</sub> (V)	Which load is selected to be adjusted (R or L)	
Test condition A										
1	100	100	0	0	248.0	15	1.00	850	/	
2	100	100	-5	-5	176.0	15	0.97	850	/	
3	100	100	-5	0	240.0	15	0.95	850	/	
4	100	100	-5	+5	216.0	15	0.93	850	/	
5	100	100	0	-5	152.0	15	1.03	850	/	
6	100	100	0	+5	223.0	15	0.98	850	/	
7	100	100	+5	-5	198.0	15	1.08	850	/	
8	100	100	+5	0	240.0	15	1.06	850	/	
9	100	100	+5	+5	234.0	15	1.03	850	/	
Test condition B										
10	66	66	0	0	189.0	9.9	1.00	620	/	
11	66	66	0	-5	170.0	9.9	1.02	620	L	
12	66	66	0	-4	199.0	9.9	1.01	620	L	
13	66	66	0	-3	181.0	9.9	1.01	620	L	
14	66	66	0	-2	194.0	9.9	1.01	620	L	
15	66	66	0	-1	164.0	9.9	1.00	620	L	
16	66	66	0	1	112.0	9.9	0.98	620	L	
17	66	66	0	2	118.0	9.9	0.98	620	L	
18	66	66	0	3	168.0	9.9	0.97	620	L	
19	66	66	0	4	154.0	9.9	0.97	620	L	
20	66	66	0	5	149.0	9.9	0.96	620	L	
Test condition C										
21	33	33	0	0	113.0	4.95	1.00	300	/	
22	33	33	0	-5	122.0	4.95	1.02	300	L	
23	33	33	0	-4	130.0	4.95	1.01	300	L	
24	33	33	0	-3	116.0	4.95	1.01	300	L	
25	33	33	0	-2	109.0	4.95	1.00	300	L	
26	33	33	0	-1	111.0	4.95	1.00	300	L	
27	33	33	0	1	130.0	4.95	0.99	300	L	
28	33	33	0	2	121.0	4.95	0.98	300	L	
29	33	33	0	3	114.0	4.95	0.98	300	L	
30	33	33	0	4	121.0	4.95	0.97	300	L	
31	33	33	0	5	102.0	4.95	0.97	300	L	



IEC61727			
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.

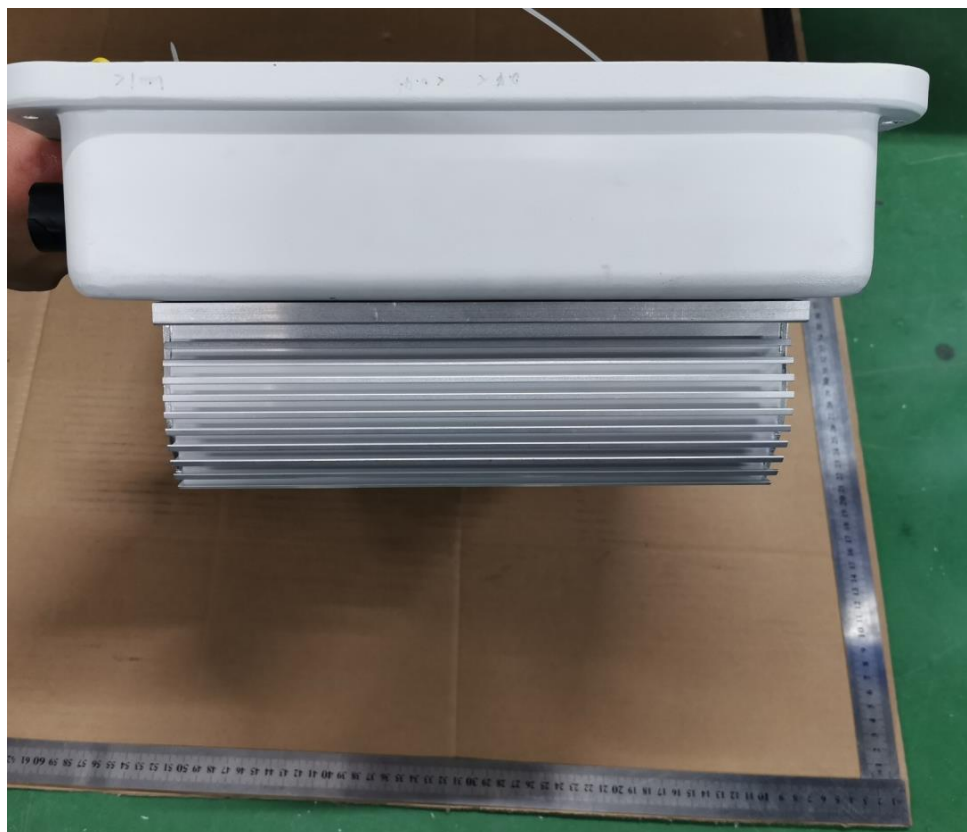
For test condition B and C:

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**



Overview



Side view

**Appendix 1: Photos**



Bottom view



Connection view for model MOD 12KTL3-X, MOD 13KTL3-X, MOD 15TL3-X

**Appendix 1: Photos**



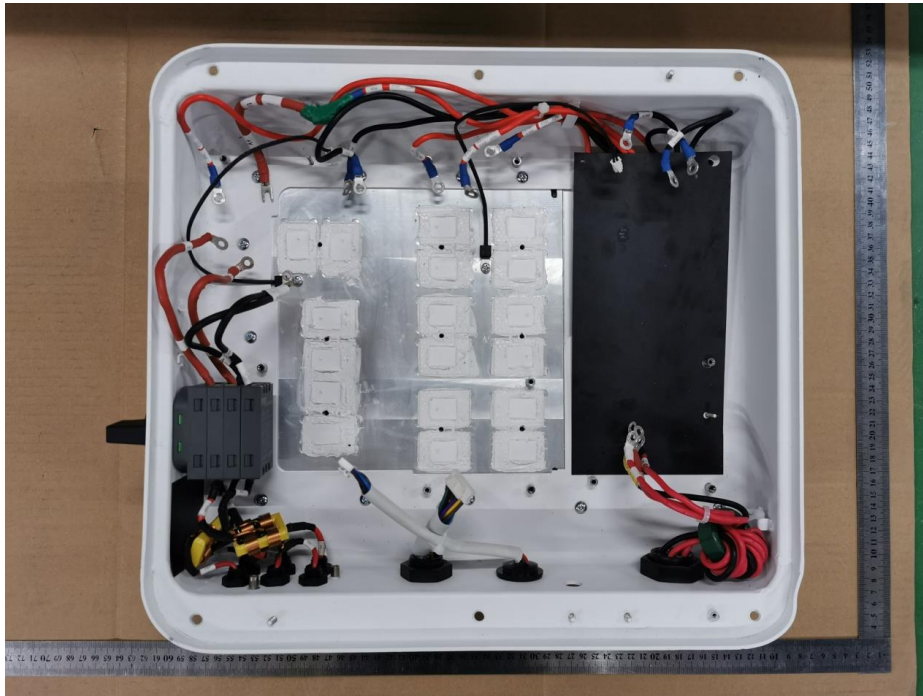
Connection view for model MOD 3000TL3-X, MOD 4000TL3-X, MOD 5000TL3-X, MOD 6000TL3-X, MOD 7000TL3-X, MOD 8000TL3-X, MOD 9000TL3-X, MOD 10KTL3-X, MOD 11KTL3-X



Internal view



**Appendix 1: Photos**



Internal view

--- End of test report---