



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

Report Number..... : 64.290.21.30204.01D

Date of issue : 2021-10-08

Total number of pages : 19

Name of Testing Laboratory preparing the Report : TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch

Applicant's name : Evolve Energy Group Co., Limited

Address : RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST
SHEUNG WAN, HONG KONG.

Test specification:

Standard : IEC 61727:2004
IEC 62116:2014

Test procedure..... : Type verification of conformity

Non-standard test method : N/A

Test Report Form No. : IEC61727A

Test Report Form(s) Originator : TÜV SÜD Product Service GmbH

Master TRF : Dated 2014-11

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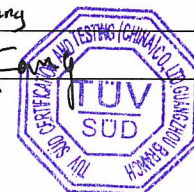
The test results presented in this report relate only to the object tested.

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Test item description	Solar Grid-tied Inverter
Trade Mark	EVVO
Manufacturer	Same as applicant
Model/Type reference	E-250KTL-HV, E-255KTL-HV
Ratings	See page 7

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

<input checked="" type="checkbox"/>	Testing Laboratory:	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
	Testing location/ address	TÜV SÜD Testing Center, D1 building, No. 63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou, P.R. China
	Tested by (name, function, signature)	Jenn Huang <i>Jenn Huang</i>
	Approved by (name, function, signature) ...	Max Fang <i>Max Fang</i>



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

N/A

Summary of testing:

Tests performed (name of test and test clause):

Clause	Requirement	Lab
4.3	flicker	(1)
4.4	DC injection	(1)
4.6	Harmonics and waveform distortion	(1)
4.7	Power factor	(1)
5.1	Loss of utility voltage	(1)
5.2.1	Over/under voltage	(1)
5.2.2	Over/under frequency	(1)
5.3	Islanding protection	(2)
5.4	Response to utility recovery	(1)

Note: If no especial indicated, all the tests are applied on model E-255KTL-HV.

Testing location:

(1) TÜV SÜD Testing Center, D1 building, No. 63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou, P.R. China

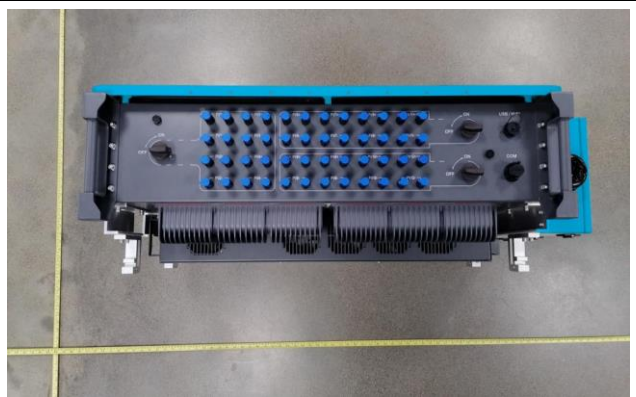
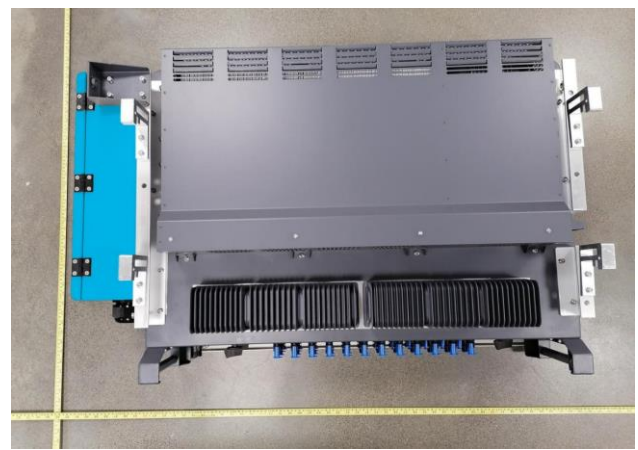
(2) China Xuchang KETOP Testing Research Institute Co., Ltd

Intersection between Weiwu Avenue and Shangde Road, Xuchang, Henan, 461000, PEOPLE'S REPUBLIC OF CHINA

Summary of compliance with National Differences:

N/A

Picture of the product:



Test item particulars	
Classification of installation and use : Fixed, outdoor	
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 : 2021-03-25, 2021-09-13	
Date (s) of performance of tests..... : 2021-03-29 to 2021-04-27, 2021-09-14 to 2021-09-30	
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 <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60384-12:	
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"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies).....	Dongguan SOFAR SOLAR Co., Ltd. 1F – 6F, Building E, No.1 JinQi Road, Bihu Industrial Park, Wulian Villiage, Fenggang Town, Dongguan, P.R. China.
General product information:	
(1) The PV grid-tied inverter is non-isolated (transformer-less) solar inverter for connection in parallel to public grid;	
(2) In order to protect the PCE, user and installer, external DC and AC circuit breakers shall be equipped at the end-use application;	
(3) Low voltage electrical installations shall comply with national and local regulation. Only qualified electricians are allowed to install and maintain the inverter;	
(4) The rated frequency setting can be set by software, after the rated frequency set, the protection setting also fixed. The frequency setting is protected by password.	

Ratings:

Model:	E-250KTL-HV	E-255KTL-HV
PV input terminal parameters:		
Max. input voltage	1500Vd.c.	
Rated input voltage	1160Vd.c.	
Start-up voltage	550Vd.c.	
MPPT operating voltage range	500~1500Vd.c.	
Full power MPPT voltage range	800~1300Vd.c.	
Number for DC inputs	24	
Number of MPP trackers	12	
Strings per MPP tracker	2	
Max. input MPPT current	30Ad.c.*12	
Max. input short circuit current	50Ad.c.*12	
AC output rating		
AC output power	250kVA@30°C / 235kVA@40°C / 220kVA@50°C	255kVA@30°C / 235kVA@40°C / 220kVA@50°C
Max. Output current	180.5Aa.c.	184Aa.c.
Nominal grid voltage	3 / PE, 800Va.c.	
Nominal frequency	50/60Hz	
Power factor	0.8 leading ~ 0.8 lagging	

IEC 61727: 2004																			
Clause	Requirement + Test	Result - Remark	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.	See the ratings	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.	(see appended table)	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.		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																
	<p align="center">Table 1 – Current distortion limits</p> <table border="1"> <thead> <tr> <th>Odd harmonics</th> <th>Distortion limit</th> </tr> </thead> <tbody> <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> </tbody> </table>		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
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 %																		

IEC 61727: 2004															
Clause	Requirement + Test	Result - Remark	Verdict												
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.	(see appended table)	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.	Internal protection function provided	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.		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												
	<p style="text-align: center;">Table 2 – Response to abnormal voltages</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Voltage (at point of utility connection)</th> <th style="text-align: center;">Maximum trip time*</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$V < 0,5 \times V_{nominal}$</td> <td style="text-align: center;">0,1 s</td> </tr> <tr> <td style="text-align: center;">$50 \% \leq V < 85 \%$</td> <td style="text-align: center;">2,0 s</td> </tr> <tr> <td style="text-align: center;">$85 \% \leq V \leq 110 \%$</td> <td style="text-align: center;">Continuous operation</td> </tr> <tr> <td style="text-align: center;">$110 \% < V < 135 \%$</td> <td style="text-align: center;">2,0 s</td> </tr> <tr> <td style="text-align: center;">$135 \% \leq V$</td> <td style="text-align: center;">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		
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														
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.	Test method refer to IEC 62116:2014	P												

IEC 61727: 2004			
Clause	Requirement + Test	Result - Remark	Verdict
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		P
	The photovoltaic system has short-circuit protection in accordance with IEC 60364-7-712.		P
5.7	Isolation and switching		P
	A method of isolation and switching is provided in accordance with IEC 60364-7-712.		P

4.3		Flicker						P	
		Starting			Stopping			Running	
		d _{max}	d _c	d _(t)	d _{max}	d _c	d _(t)	P _{st}	P _{lt} 2 hours
Measured Values	L1	0.33	0.23	0.0	0.35	0.08	0.0	0.06	0.45
	L2	0.26	0.02	0.0	0.18	0.10	0.0	0.05	0.41
	L3	0.10	0.04	0.0	0.25	0.05	0.0	0.06	0.44
Limits		4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65
Supplementary information:									

4.4		DC injection						P		
Test power level		33%			66%			100%		
Phase		L1	L2	L3	L1	L2	L3	L1	L2	L3
Test results (Amp)		0.504	0.448	0.339	0.442	0.433	0.493	0.104	0.073	0.078
Test results (% of rated output current)		0.274	0.253	0.184	0.241	0.235	0.268	0.056	0.039	0.042
Limit		1.0%			1.0%			1.0%		
Supplementary information:										

4.6		Harmonics and waveform distortion					
P / P _n		33%					
Harmonic	measured in Amp			% of Rated current			Limits (% of Rated current)
	L1	L2	L3	L1	L2	L3	
1	60.53	60.68	60.80	-	-	-	--
2	0.35	0.23	0.23	0.12%	0.19%	0.13%	1.0%
3	0.33	0.25	0.25	0.13%	0.18%	0.14%	4.0%
4	0.21	0.14	0.16	0.08%	0.11%	0.09%	1.0%
5	0.20	0.24	0.24	0.13%	0.11%	0.13%	4.0%
6	0.10	0.05	0.23	0.03%	0.05%	0.12%	1.0%
7	0.15	0.13	0.25	0.07%	0.08%	0.13%	4.0%
8	0.32	0.17	0.38	0.09%	0.17%	0.21%	1.0%
9	0.36	0.38	0.28	0.20%	0.20%	0.15%	4.0%
10	0.43	0.19	0.32	0.10%	0.24%	0.17%	0.5%
11	0.22	0.46	0.18	0.25%	0.12%	0.10%	2.0%
12	0.16	0.10	0.11	0.05%	0.09%	0.06%	0.5%
13	0.18	0.15	0.17	0.08%	0.10%	0.09%	2.0%
14	0.11	0.10	0.20	0.06%	0.06%	0.11%	0.5%
15	0.11	0.07	0.05	0.04%	0.06%	0.03%	2.0%
16	0.06	0.06	0.06	0.03%	0.03%	0.03%	0.5%
17	0.12	0.15	0.11	0.08%	0.06%	0.06%	1.5%
18	0.11	0.13	0.14	0.07%	0.06%	0.07%	0.5%

19	0.11	0.18	0.11	0.10%	0.06%	0.06%	1.5%
20	0.11	0.18	0.08	0.10%	0.06%	0.04%	0.5%
21	0.06	0.06	0.04	0.03%	0.04%	0.02%	1.5%
22	0.10	0.04	0.08	0.02%	0.05%	0.04%	0.5%
23	0.14	0.16	0.14	0.09%	0.07%	0.07%	0.6%
24	0.07	0.05	0.06	0.02%	0.04%	0.03%	0.5%
25	0.10	0.08	0.09	0.05%	0.06%	0.05%	0.6%
26	0.08	0.09	0.05	0.05%	0.04%	0.03%	0.5%
27	0.04	0.04	0.04	0.02%	0.02%	0.02%	0.6%
28	0.07	0.04	0.04	0.02%	0.04%	0.02%	0.5%
29	0.10	0.14	0.18	0.07%	0.05%	0.10%	0.6%
30	0.07	0.06	0.06	0.03%	0.04%	0.03%	0.5%
31	0.09	0.10	0.12	0.06%	0.05%	0.06%	0.6%
32	0.05	0.05	0.04	0.03%	0.03%	0.02%	0.5%
33	0.04	0.05	0.05	0.03%	0.02%	0.03%	0.6%
THD (%)	-	-	-	0.51%	0.55%	0.52%	5.0%
P / Pn	66%						
Harmonic	measured in Amp			% of Rated current			Limits (% of Rated current)
	L1	L2	L3	L1	L2	L3	
1	121.17	121.57	121.79	-	-	-	--
2	0.45	0.32	0.35	0.24%	0.17%	0.19%	1.0%
3	0.36	0.33	0.25	0.19%	0.18%	0.13%	4.0%
4	0.20	0.22	0.21	0.11%	0.12%	0.12%	1.0%
5	0.43	0.53	0.15	0.23%	0.29%	0.08%	4.0%
6	0.22	0.07	0.38	0.12%	0.04%	0.21%	1.0%
7	0.22	0.29	0.15	0.12%	0.16%	0.08%	4.0%
8	0.28	0.27	0.32	0.15%	0.14%	0.17%	1.0%
9	0.12	0.19	0.14	0.06%	0.10%	0.07%	4.0%
10	0.19	0.28	0.17	0.10%	0.15%	0.09%	0.5%
11	0.26	0.45	0.16	0.14%	0.24%	0.09%	2.0%
12	0.17	0.15	0.18	0.09%	0.08%	0.10%	0.5%
13	0.17	0.27	0.18	0.09%	0.14%	0.10%	2.0%
14	0.41	0.21	0.37	0.22%	0.11%	0.20%	0.5%
15	0.17	0.30	0.07	0.09%	0.16%	0.04%	2.0%
16	0.11	0.08	0.22	0.06%	0.04%	0.12%	0.5%
17	0.18	0.31	0.12	0.10%	0.17%	0.07%	1.5%
18	0.35	0.18	0.33	0.19%	0.10%	0.18%	0.5%
19	0.44	0.45	0.10	0.24%	0.25%	0.05%	1.5%
20	0.30	0.15	0.44	0.16%	0.08%	0.24%	0.5%
21	0.14	0.23	0.08	0.08%	0.12%	0.04%	1.5%



22	0.14	0.07	0.05	0.08%	0.04%	0.03%	0.5%
23	0.12	0.19	0.11	0.06%	0.10%	0.06%	0.6%
24	0.11	0.05	0.07	0.06%	0.02%	0.04%	0.5%
25	0.17	0.13	0.09	0.09%	0.07%	0.05%	0.6%
26	0.06	0.09	0.17	0.03%	0.05%	0.09%	0.5%
27	0.06	0.04	0.04	0.03%	0.02%	0.02%	0.6%
28	0.07	0.05	0.05	0.04%	0.03%	0.03%	0.5%
29	0.08	0.16	0.08	0.04%	0.09%	0.05%	0.6%
30	0.08	0.08	0.08	0.04%	0.04%	0.04%	0.5%
31	0.09	0.13	0.09	0.05%	0.07%	0.05%	0.6%
32	0.05	0.05	0.06	0.03%	0.03%	0.03%	0.5%
33	0.06	0.05	0.04	0.03%	0.03%	0.02%	0.6%
THD (%)	-	-	-	0.70%	0.73%	0.61%	5.0%
P / Pn	100%						
Harmonic	measured in Amp			% of Rated current			Limits (% of Rated current)
	L1	L2	L3	L1	L2	L3	
1	185.71	184.02	183.86	-	-	-	--
2	0.08	0.16	0.18	0.04%	0.09%	0.10%	1.0%
3	0.32	0.17	0.10	0.17%	0.09%	0.05%	4.0%
4	0.19	0.16	0.13	0.10%	0.08%	0.07%	1.0%
5	0.31	0.11	0.26	0.17%	0.06%	0.14%	4.0%
6	0.07	0.05	0.05	0.04%	0.03%	0.03%	1.0%
7	0.27	0.31	0.28	0.15%	0.17%	0.15%	4.0%
8	0.12	0.17	0.15	0.06%	0.09%	0.08%	1.0%
9	0.13	0.08	0.17	0.07%	0.04%	0.09%	4.0%
10	0.19	0.15	0.10	0.10%	0.08%	0.05%	0.5%
11	0.33	0.22	0.33	0.18%	0.12%	0.18%	2.0%
12	0.08	0.04	0.08	0.05%	0.02%	0.04%	0.5%
13	0.28	0.25	0.28	0.15%	0.14%	0.15%	2.0%
14	0.12	0.17	0.12	0.07%	0.09%	0.07%	0.5%
15	0.10	0.05	0.10	0.05%	0.03%	0.05%	2.0%
16	0.21	0.17	0.10	0.12%	0.09%	0.05%	0.5%
17	0.08	0.06	0.05	0.04%	0.03%	0.03%	1.5%
18	0.09	0.04	0.08	0.05%	0.02%	0.04%	0.5%
19	0.06	0.07	0.07	0.03%	0.04%	0.04%	1.5%
20	0.17	0.19	0.13	0.09%	0.10%	0.07%	0.5%
21	0.05	0.04	0.05	0.03%	0.02%	0.03%	1.5%
22	0.16	0.12	0.07	0.09%	0.07%	0.04%	0.5%
23	0.18	0.17	0.20	0.10%	0.09%	0.11%	0.6%
24	0.06	0.04	0.05	0.03%	0.02%	0.03%	0.5%

25	0.17	0.18	0.17	0.09%	0.10%	0.09%	0.6%
26	0.12	0.14	0.11	0.07%	0.08%	0.06%	0.5%
27	0.04	0.04	0.05	0.02%	0.02%	0.03%	0.6%
28	0.10	0.09	0.06	0.05%	0.05%	0.03%	0.5%
29	0.11	0.12	0.12	0.06%	0.06%	0.07%	0.6%
30	0.04	0.03	0.04	0.02%	0.02%	0.02%	0.5%
31	0.09	0.08	0.07	0.05%	0.04%	0.04%	0.6%
32	0.08	0.08	0.06	0.04%	0.04%	0.03%	0.5%
33	0.06	0.05	0.06	0.03%	0.03%	0.04%	0.6%
THD (%)	-	-	-	0.50%	0.42%	0.44%	5.0%

Supplementary information:
Test on 50Hz;

P / Pn	33%							
	Harmonic	measured in Amp			% of Rated current			Limits (% of Rated current)
		L1	L2	L3	L1	L2	L3	
1	61.13	61.34	61.49	-	-	-	--	
2	0.29	0.24	0.24	0.16%	0.13%	0.13%	1.0%	
3	0.43	0.24	0.33	0.23%	0.13%	0.18%	4.0%	
4	0.24	0.20	0.22	0.13%	0.11%	0.12%	1.0%	
5	0.33	0.29	0.30	0.18%	0.16%	0.16%	4.0%	
6	0.16	0.10	0.29	0.09%	0.05%	0.16%	1.0%	
7	0.23	0.19	0.29	0.13%	0.11%	0.16%	4.0%	
8	0.34	0.21	0.41	0.18%	0.11%	0.22%	1.0%	
9	0.40	0.37	0.30	0.22%	0.20%	0.16%	4.0%	
10	0.44	0.23	0.38	0.24%	0.13%	0.20%	0.5%	
11	0.26	0.49	0.20	0.14%	0.27%	0.11%	2.0%	
12	0.23	0.14	0.14	0.12%	0.07%	0.07%	0.5%	
13	0.22	0.19	0.19	0.12%	0.10%	0.11%	2.0%	
14	0.13	0.12	0.21	0.07%	0.07%	0.11%	0.5%	
15	0.18	0.11	0.09	0.10%	0.06%	0.05%	2.0%	
16	0.11	0.10	0.10	0.06%	0.06%	0.06%	0.5%	
17	0.17	0.17	0.13	0.09%	0.09%	0.07%	1.5%	
18	0.16	0.13	0.14	0.09%	0.07%	0.08%	0.5%	
19	0.13	0.19	0.12	0.07%	0.10%	0.06%	1.5%	
20	0.15	0.20	0.10	0.08%	0.11%	0.06%	0.5%	
21	0.10	0.10	0.09	0.06%	0.05%	0.05%	1.5%	
22	0.13	0.10	0.11	0.07%	0.05%	0.06%	0.5%	
23	0.15	0.18	0.15	0.08%	0.10%	0.08%	0.6%	
24	0.10	0.09	0.09	0.06%	0.05%	0.05%	0.5%	

25	0.19	0.12	0.10	0.10%	0.06%	0.06%	0.6%
26	0.13	0.11	0.09	0.07%	0.06%	0.05%	0.5%
27	0.11	0.10	0.09	0.06%	0.05%	0.05%	0.6%
28	0.18	0.18	0.17	0.10%	0.10%	0.09%	0.5%
29	0.12	0.14	0.16	0.07%	0.08%	0.09%	0.6%
30	0.23	0.10	0.10	0.13%	0.05%	0.05%	0.5%
31	0.21	0.13	0.13	0.11%	0.07%	0.07%	0.6%
32	0.18	0.17	0.16	0.10%	0.09%	0.08%	0.5%
33	0.12	0.10	0.09	0.07%	0.05%	0.05%	0.6%
THD (%)	-	-	-	0.69%	0.59%	0.62%	5.0%
P / Pn	66%						
Harmonic	measured in Amp			% of Rated current			Limits (% of Rated current)
	L1	L2	L3	L1	L2	L3	
1	122.90	123.22	123.62	-	-	-	--
2	0.44	0.29	0.31	0.24%	0.16%	0.19%	1.0%
3	0.46	0.37	0.30	0.25%	0.20%	0.13%	4.0%
4	0.18	0.19	0.18	0.10%	0.10%	0.12%	1.0%
5	0.62	0.62	0.25	0.34%	0.34%	0.08%	4.0%
6	0.21	0.11	0.40	0.11%	0.06%	0.21%	1.0%
7	0.26	0.31	0.24	0.14%	0.17%	0.08%	4.0%
8	0.30	0.24	0.26	0.17%	0.13%	0.17%	1.0%
9	0.17	0.22	0.16	0.09%	0.12%	0.07%	4.0%
10	0.28	0.26	0.13	0.15%	0.14%	0.09%	0.5%
11	0.42	0.50	0.27	0.23%	0.27%	0.09%	2.0%
12	0.23	0.20	0.28	0.12%	0.11%	0.10%	0.5%
13	0.23	0.23	0.24	0.12%	0.13%	0.10%	2.0%
14	0.28	0.13	0.29	0.15%	0.07%	0.20%	0.5%
15	0.22	0.27	0.11	0.12%	0.15%	0.04%	2.0%
16	0.30	0.23	0.36	0.16%	0.13%	0.12%	0.5%
17	0.26	0.23	0.17	0.14%	0.12%	0.07%	1.5%
18	0.36	0.19	0.27	0.19%	0.10%	0.18%	0.5%
19	0.38	0.47	0.13	0.21%	0.26%	0.05%	1.5%
20	0.39	0.26	0.51	0.21%	0.14%	0.24%	0.5%
21	0.18	0.23	0.11	0.10%	0.12%	0.04%	1.5%
22	0.14	0.10	0.12	0.07%	0.06%	0.03%	0.5%
23	0.14	0.20	0.12	0.08%	0.11%	0.06%	0.6%
24	0.15	0.09	0.08	0.08%	0.05%	0.04%	0.5%
25	0.19	0.14	0.12	0.10%	0.08%	0.05%	0.6%
26	0.12	0.10	0.17	0.07%	0.05%	0.09%	0.5%
27	0.12	0.09	0.08	0.06%	0.05%	0.02%	0.6%

28	0.18	0.19	0.18	0.10%	0.10%	0.03%	0.5%
29	0.12	0.19	0.13	0.06%	0.10%	0.05%	0.6%
30	0.22	0.13	0.11	0.12%	0.07%	0.04%	0.5%
31	0.20	0.14	0.11	0.11%	0.08%	0.05%	0.6%
32	0.30	0.29	0.26	0.16%	0.16%	0.03%	0.5%
33	0.12	0.09	0.08	0.06%	0.05%	0.02%	0.6%
THD (%)	-	-	-	0.87%	0.80%	0.70%	5.0%
P / Pn	100%						
Harmonic	measured in Amp			% of Rated current			Limits (% of Rated current)
	L1	L2	L3	L1	L2	L3	
1	184.97	183.38	183.26	-	-	-	--
2	0.08	0.15	0.17	0.05%	0.08%	0.09%	1.0%
3	0.31	0.19	0.10	0.17%	0.10%	0.05%	4.0%
4	0.17	0.14	0.12	0.09%	0.08%	0.06%	1.0%
5	0.31	0.10	0.28	0.17%	0.06%	0.15%	4.0%
6	0.08	0.06	0.06	0.04%	0.03%	0.03%	1.0%
7	0.29	0.31	0.31	0.16%	0.17%	0.17%	4.0%
8	0.12	0.21	0.20	0.06%	0.11%	0.11%	1.0%
9	0.11	0.09	0.16	0.06%	0.05%	0.09%	4.0%
10	0.19	0.15	0.11	0.11%	0.08%	0.06%	0.5%
11	0.34	0.22	0.34	0.18%	0.12%	0.19%	2.0%
12	0.08	0.05	0.08	0.05%	0.03%	0.04%	0.5%
13	0.30	0.28	0.29	0.17%	0.15%	0.16%	2.0%
14	0.10	0.15	0.12	0.05%	0.08%	0.07%	0.5%
15	0.11	0.07	0.11	0.06%	0.04%	0.06%	2.0%
16	0.20	0.15	0.10	0.11%	0.08%	0.05%	0.5%
17	0.09	0.10	0.06	0.05%	0.05%	0.03%	1.5%
18	0.09	0.05	0.09	0.05%	0.03%	0.05%	0.5%
19	0.09	0.12	0.11	0.05%	0.06%	0.06%	1.5%
20	0.12	0.16	0.12	0.07%	0.09%	0.06%	0.5%
21	0.06	0.06	0.06	0.03%	0.03%	0.03%	1.5%
22	0.15	0.12	0.07	0.08%	0.06%	0.04%	0.5%
23	0.16	0.16	0.18	0.09%	0.09%	0.10%	0.6%
24	0.08	0.06	0.06	0.04%	0.03%	0.03%	0.5%
25	0.21	0.23	0.20	0.11%	0.12%	0.11%	0.6%
26	0.12	0.14	0.11	0.06%	0.08%	0.06%	0.5%
27	0.05	0.06	0.05	0.03%	0.03%	0.02%	0.6%
28	0.11	0.10	0.07	0.06%	0.05%	0.04%	0.5%
29	0.10	0.11	0.12	0.06%	0.06%	0.06%	0.6%
30	0.05	0.05	0.04	0.03%	0.03%	0.02%	0.5%



31	0.13	0.11	0.11	0.07%	0.06%	0.06%	0.6%
32	0.06	0.08	0.06	0.03%	0.04%	0.03%	0.5%
33	0.05	0.06	0.05	0.03%	0.03%	0.03%	0.6%
THD (%)	-	-	-	0.51%	0.44%	0.47%	5.0%

Supplementary information:

Test on 60Hz;

4.7		Power factor								P
No	Input			Output						Rated output (V.A)
	Voltage (V d.c.)	Current (A d.c.)	Power (kW)	Voltage (V a.c.)	Current (A a.c.)			Power (kW)	Power factor (+/-)	
1	1089.4	49.0	53.4	800.1	37.1	37.3	37.5	51.6	0.9989	(20±5)%
2	1076.1	73.3	78.9	800.2	55.5	55.9	55.9	77.2	0.9993	(30±5)%
3	1077.0	96.7	104.2	800.2	73.1	73.6	73.6	101.7	0.9994	(40±5)%
4	1075.5	121.7	130.9	800.3	92.3	92.6	92.6	128.2	0.9996	(50±5)%
5	1206.5	130.4	157.3	800.4	111.1	111.4	111.6	154.4	0.9996	(60±5)%
6	1159.7	156.0	180.9	801.3	129.4	128.4	128.2	178.3	0.9982	(70±5)%
7	1159.6	178.5	207.0	801.4	148.0	146.8	146.7	203.9	0.9982	(80±5)%
8	1159.5	201.1	233.1	801.5	166.6	165.2	165.1	229.5	0.9982	(90±5)%
9	1159.4	223.6	259.2	801.6	185.1	183.5	183.4	255.0	0.9981	(100±5)%

Supplementary information:

Test on 50Hz;

5.1		Islanding protection							P
No.	P _{EUT} (% of EUT rating)	Reactive Load (% of Q _L)	P _{AC} (% of nominal)	Q _{AC} (% of nominal)	Run on time (ms)	P _{EUT} (kW)	Actual Q _f (Var)	V _{DC} (V)	Remarks
1	100	100	0	0	465	250.7	0.999	1250	Test A at BL
2	66	66	0	0	495	168.7	0.998	1050	Test B at BL
3	33	33	0	0	508	85.0	0.999	900	Test C at BL
4	100	100	-5	-5	145	249.7	1.059	1250	Test A at IB
5	100	100	-5	0	459	248.4	1.052	1250	Test A at IB
6	100	100	-5	5	367	249.1	1.040	1250	Test A at IB
7	100	100	0	-5	123	249.7	1.028	1250	Test A at IB
8	100	100	0	5	411	250.0	1.018	1250	Test A at IB
9	100	100	5	-5	155	249.8	0.976	1250	Test A at IB
10	100	100	5	0	435	248.7	0.952	1250	Test A at IB
11	100	100	5	5	457	251.4	0.976	1250	Test A at IB
12	66	66	0	-5	116	168.0	1.061	1050	Test B at IB
13	66	66	0	-4	120	167.6	1.050	1050	Test B at IB
14	66	66	0	-3	152	168.3	1.041	1050	Test B at IB
15	66	66	0	-2	340	167.0	1.028	1050	Test B at IB
16	66	66	0	-1	376	167.0	1.020	1050	Test B at IB
17	66	66	0	1	423	168.3	0.995	1050	Test B at IB
18	66	66	0	2	493	168.7	0.989	1050	Test B at IB
19	66	66	0	3	481	167.2	0.979	1050	Test B at IB
20	66	66	0	4	356	167.9	0.969	1050	Test B at IB
21	66	66	0	5	396	167.7	0.961	1050	Test B at IB
22	66	66	0	6	472	167.3	1.031	1050	Test B at IB
23	66	66	0	7	480	167.4	1.034	1050	Test B at IB
24	66	66	0	8	495	168.2	1.038	1050	Test B at IB
25	66	66	0	9	220	168.5	1.040	1050	Test B at IB
26	33	33	0	-5	112	85.0	1.061	900	Test C at IB
27	33	33	0	-4	114	83.1	1.049	900	Test C at IB
28	33	33	0	-3	128	83.8	1.040	900	Test C at IB
29	33	33	0	-2	132	83.6	1.027	900	Test C at IB
30	33	33	0	-1	708	83.8	1.020	900	Test C at IB

31	33	33	0	1	1468	83.3	0.999	900	Test C at IB
32	33	33	0	2	496	83.3	0.988	900	Test C at IB
33	33	33	0	3	720	83.2	0.976	900	Test C at IB
34	33	33	0	4	736	84.0	0.971	900	Test C at IB
35	33	33	0	5	136	84.5	0.957	900	Test C at IB

Supplementary information:

1. Test on 50Hz;
2. Test method are referred to IEC 62116:2014.

TABLE: Islanding protection									P
No.	P _{EUT} (% of EUT rating)	Reactive Load (% of Q _L)	P _{AC} (% of nominal)	Q _{AC} (% of nominal)	Run on time (ms)	P _{EUT} (kW)	Actual Q _f	BAT (Vdc)	Remarks
1	100	100	0	0	338	251.2	0.999	1250	Test A at
2	66	66	0	0	306	168.3	0.999	1050	Test B at
3	33	33	0	0	304	84.6	0.999	900	Test C at

Supplementary information:

1. Test on 60Hz;
2. Test method are referred to IEC 62116:2014.

5.2.1 & 5.4 Over/under voltage & Response to utility recovery						P
No.	Utility point Voltage (V)	Maximum trip time (s)	Measured trip time (ms)	Utility return to the specified ranges(V)	Measured Self-check time (s)	Limit of Self-check time (s)
01	L1: V=0,49 Vn	0,1 s	92.2	800V	122	20 s – 300 s
	L2: V=0,49 Vn		73.1			
	L3: V=0,49 Vn		81.7			
	L1, L2, L3: V=0,49 Vn		79.3			
02	L1:V=0,50Vn	2,0 s	1963	800V	122	20 s – 300 s
	L2:V=0,50Vn		1964			
	L3: V=0,50Vn		1964			
	L1, L2, L3: V=0,50Vn		83.4			
03	L1:V=0,84 Vn	2,0 s	1976	800V	121	20 s – 300 s
	L2:V=0,84 Vn		1949			
	L3: V=0,84 Vn		1964			
	L1, L2, L3: V=0,84 Vn		1962			
04	L1:V=1,11 Vn	2,0 s	1952	800V	122	20 s – 300 s
	L2:V=1,11 Vn		1982			
	L3: V=1,11 Vn		1949			
	L1, L2, L3: V=1,11 Vn		1968			
05	L1:V=1,34 Vn	2,0 s	10.24	800V	146	20 s – 300 s

	L2:V=1,34 Vn		46.16			
	L3: V=1,34 Vn		16.78			
	L1, L2, L3: V=1,34 Vn		8.88			
06	L1:V=1,35Vn	0,05 s	10.15	800V	147	20 s – 300 s
	L2:V=1,35Vn		28.62			
	L3: V=1,35Vn		12.50			
	L1, L2, L3: V=1,35Vn		7.75			
07	L1:V=0,85 Vn	Shall No trip	--	--	No trip	--
	L2:V=0,85 Vn		--			
	L3: V=0,85 Vn		--			
	L1, L2, L3: V=0,85 Vn		--			
08	L1:V=1,10 Vn	Shall No trip	--	--	No trip	--
	L2:V=1,10 Vn		--			
	L3: V=1,10 Vn		--			
	L1, L2, L3: V=1,10 Vn		--			
Vn=800V						

5.2.2 & 5.4		Over/under frequency & Response to utility recovery				P
No.	Utility point Frequency(Fn)	Maximum trip time (s)	Measured trip time (ms)	Utility return to the specified ranges(Fn)	Measured Self-check time (s)	Limit of Self-check time (s)
01	F=49Hz	0,2 s	177.5	Fn=50 Hz	117	20 s – 300 s
02	F=51Hz	0,2 s	176.7	Fn=50 Hz	117	20 s – 300 s
Fn=50 Hz						
01	F=59Hz	0,2 s	160.6	Fn=60 Hz	117	20 s – 300 s
02	F=61Hz	0,2 s	175.6	Fn=60 Hz	116	20 s – 300 s
Fn=60 Hz						

--- End of test report---