Test Report issued under the responsibility of:

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

Report Number. .....:	GZES201103204501
Date of issue .....:	09 / 12 / 2020
Total number of pages	40
Name of Testing Laboratory preparing the Report .....:	SGS-CSTC Standards Technical Services 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,HK
Test specification:	
Standard .....:	IEC 61727:2004 (Second Edition)
Test procedure.....:	Characteristic Examination
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

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

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.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description .....:	Solar Grid-tied Inverter (Three Phase)
Trade Mark .....:	EVVO
Manufacturer.....:	EVOLVE ENERGY GROUP CO., LIMITED
Address .....:	RM 702,7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN,HK
Model/Type reference .....:	E- 75KTL, E- 80KTL, E- 100KTL, E- 110KTL E- 100KTL-HV, E- 125KTL-HV, E- 136KTL-HV
Ratings .....:	See model list in Page 7 and Page 8. **Serial Number:** SQ1ES1A0L85001 **Firmware version:** ARM V020010 DSPS V020010 DSPM V020010

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☐ ~~CB Testing Laboratory:~~		
~~Testing location/ address.....:~~		
☐ ~~Associated CB Testing Laboratory:~~		
~~Testing location/ address.....:~~		
~~Tested by (name, function, signature).....:~~		
~~Approved by (name, function, signature)...:~~		
☒ **Testing procedure: TMP/CTF Stage 1:**	Shenzhen BALUN Technology Co., Ltd.	
Testing location/ address.....:	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong, China	
Tested by (name, function, signature).....:	Hugo Zhang (Project Engineer)	Hugo Zhang
Approved by (name, function, signature....:	Roger Hu (Technical Reviewer)	Roger Hu
☐ ~~Testing procedure: WMT/CTF Stage 2:~~		
~~Testing location/ address.....:~~		
~~Tested by (name, function, signature).....:~~		
~~Witnessed by (name, function, signature) .:~~		
~~Approved by (name, function, signature)...:~~		
☐ ~~Testing procedure: SMT/CTF Stage 3 or 4:~~		
~~Testing location/ address.....:~~		
~~Tested by (name, function, signature).....:~~		
~~Witnessed by (name, function, signature) .:~~		
~~Approved by (name, function, signature)...:~~		
~~Supervised by (name, function, signature) :~~		

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

50Hz/60Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	18 pages
Attachment II	Testing Information	5 pages
Attachment III	Graphs and Screenshots of Test Results	54 pages

Summary of testing:

Tests performed (name of test and test clause):

The equipment has been tested according to the standard:
IEC 61727:2004. Testing has been carried out at 50 Hz

All applicable tests according to the above specified standard have been carried out.

From the result of inspection and tests on the submitted sample, we conclude that it complies with the requirements of the standard.

Remarks: All the test results are from the report below:

- IEC 61727:2004 (Second Edition)

  Test Report No: GZES201203336801

Testing location:

Shenzhen BALUN Technology Co., Ltd.

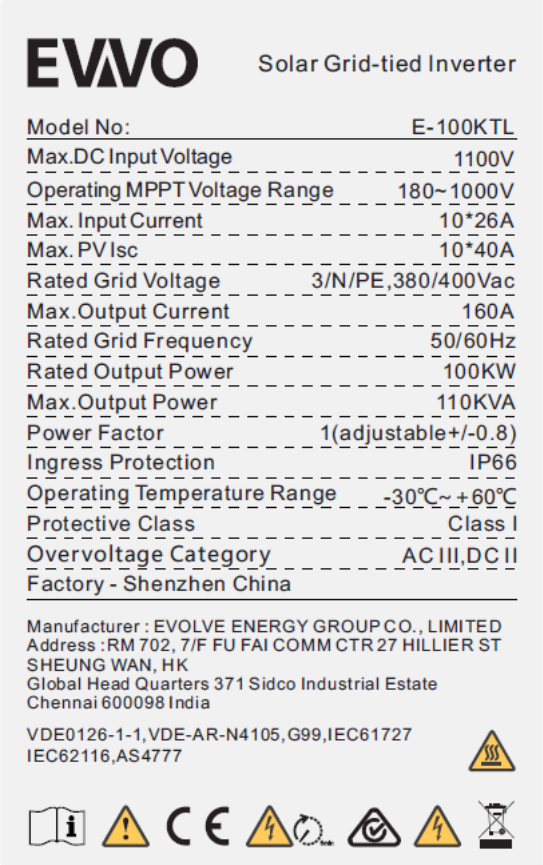
Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong, China

(All clauses)

Summary of compliance with National Differences:

No National Differences are addressed to this test report

Copy of marking plate(representative):



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. Labels of other models are as the same with E- 100KTL's except the parameters of rating.

Test item particulars.....:	Solar Grid-tied Inverter (Three Phase)
Classification of installation and use.....:	Fixed (permanent connection)
Supply Connection.....:	DC; PV
.....:	AC; Grid 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.....:	CTF Stage 1 procedure
Date of receipt of test item .....:	N/A
Date (s) of performance of tests.....:	From 20/07/2020 to 26/07/2020

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.

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).....:	Dongguan SOFARSOLAR Co., Ltd. 1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan, Guangdong, China.

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors.

The Solar inverter converts DC voltage into AC voltage.
The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit can operate in case of one error.

Equipment Under Testing:

- E- 100KTL

Variant models:

- E- 75KTL
- E- 80KTL
- E- 110KTL
- E- 100KTL-HV
- E- 125KTL-HV
- E- 136KTL-HV

Model	E- 75KTL	E- 80KTL	E- 100KTL	E- 110KTL	E- 100KTL -HV	E- 125KTL -HV	E- 136KTL -HV
DC Input							
Max. DC voltage	1100V						
Rated input voltage	625V	625V	625V	625V	725V	725V	785V
Start-up operating voltage	200V						
MPPT voltage range	180V~1000V						
Full power MPPT voltage range	500V-850V				550V-850V		
Max. input current	8*26A	8*26A	10*26A	10*26A	10*26A	10*26A	12*26A
Max. input short circuit current	8*40A	8*40A	10*40A	10*40A	10*40A	10*40A	12*40A
AC Output							
Rated power	75kW	80kW	100kW	110kW	100kW	125kW	136kW
Max. AC power	75kVA	88kVA	110kVA	121kVA	110kVA	137kVA	150kVA
Max. output current	113A	128A	160A	175A	128A	160A	160A

Nominal grid voltage	3/N/PE, 380V/400Vac	3/PE, 500Vac	3/PE, 540Vac
Nominal output freqency	50Hz/60Hz		
Output power factor	1 default (adjustable +/-0.8)		
Operating temperature range	-30ºC ~60ºC		
Ingress protection	IP66		
Protective class	Class I		

The variants models have been included in this test report without tests because the following features don´t change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Output power within 1/√10 and 2 times of the rated output power or the EUT or Modular inverters.
- Same Firmware Version

IEC 61727			
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.		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.	**(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

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	**(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.		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.	**(see appended table)**	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
	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**

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict
	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 according IEC 62116: 2014 Refer to Test Report No: GZES201103204502	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**		**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

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.3	TABLE: Flicker			P
	Starting	Stopping	Running	
Limit	4%	4%	Pst = 1.0	Plt = 0.65
33%Pn for 50Hz				
Test value (Phase A)	0.480	0.448	0.234	0.221
Test value (Phase B)	0.469	0.413	0.233	0.227
Test value (Phase C)	0.432	0.458	0.244	0.233
66%Pn for 50Hz				
Test value (Phase A)	0.363	0.358	0.255	0.246
Test value (Phase B)	0.524	0.517	0.258	0.247
Test value (Phase C)	0.440	0.352	0.253	0.230
100%Pn for 50Hz				
Test value (Phase A)	0.407	0.379	0.323	0.296
Test value (Phase B)	0.580	0.544	0.357	0.320
Test value (Phase C)	0.351	0.303	0.385	0.339
33%Pn for 60Hz				
Test value (Phase A)	0.359	0.365	0.276	0.274
Test value (Phase B)	0.450	0.457	0.278	0.277
Test value (Phase C)	0.495	0.417	0.282	0.281
66%Pn for 60Hz				
Test value (Phase A)	0.365	0.355	0.290	0.278
Test value (Phase B)	0.440	0.464	0.290	0.280
Test value (Phase C)	0.355	0.375	0.281	0.272
100%Pn for 60Hz				
Test value (Phase A)	0.408	0.423	0.297	0.279
Test value (Phase B)	0.499	0.462	0.304	0.273
Test value (Phase C)	0.350	0.367	0.294	0.278

Supplementary information:
The measurements of voltage fluctuations have been measured at 33 %, 66% and 100 % of the nominal power value of the inverter.
As it can be seen in screenshots in Attachment III, this test has two steps and 10min for each step:

1.Starting operation

2.Stopping operation

The values took of Pst and Plt are the most unfavorable of the two steps.
As it can be seen in the screenshots in Attachment III. The values took of Pst and Plt are the most unfavorable of the twelve steps and 10min for each step for running operation

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.4	TABLE: Direct current injection								P
50Hz									
Rated output current (A)	**Ratio of rated output power (VA)**	**Measured DC output current between terminals (A)**						**Isolated transformer ? (Yes/No)**	**Limit (A)**
		L1-L2	**L1-L3**	**L2-L3**	**L1-N**	**L2-N**	**L3-N**		
144.9	33%	--	--	--	0.107	0.388	0.096	**No**	1.449
144.9	66%	--	--	--	0.090	0.336	0.099	**No**	1.449
144.9	100%	--	--	--	0.206	0.103	0.142	**No**	1.449
60Hz									
Rated output current (A)	**Ratio of rated output power (VA)**	**Measured DC output current between terminals (A)**						**Isolated transformer ? (Yes/No)**	**Limit (A)**
		L1-L2	**L1-L3**	**L2-L3**	**L1-N**	**L2-N**	**L3-N**		
151.5	33%	--	--	--	0.152	0.273	0.181	**No**	1.515
151.5	66%	--	--	--	0.164	0.177	0.220	**No**	1.515
151.5	100%	--	--	--	0.178	0.111	0.152	**No**	1.515

Supplementary information:
N/A

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(a)	Table: harmonics and waveform distortion (at 33%Pn Phase A, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.205	1.000	03	0.201	4.000
04	0.177	1.000	05	0.511	4.000
06	0.429	1.000	07	0.278	4.000
08	0.177	1.000	09	0.277	4.000
10	0.165	0.500	11	0.404	2.000
12	0.255	0.500	13	0.251	2.000
14	0.143	0.500	15	0.224	2.000
16	0.150	0.500	17	0.244	1.500
18	0.227	0.500	19	0.226	1.500
20	0.134	0.500	21	0.192	1.500
22	0.125	0.500	23	0.187	0.600
24	0.141	0.500	25	0.214	0.600
26	0.157	0.500	27	0.142	0.600
28	0.105	0.500	29	0.179	0.600
30	0.134	0.500	31	0.238	0.600
32	0.189	0.500	33	0.122	0.600
THD	1.305	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(b)	Table: harmonics and waveform distortion (at 33%Pn Phase B, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.192	1.000	03	0.195	4.000
04	0.168	1.000	05	0.315	4.000
06	0.455	1.000	07	0.325	4.000
08	0.155	1.000	09	0.230	4.000
10	0.154	0.500	11	0.348	2.000
12	0.260	0.500	13	0.311	2.000
14	0.142	0.500	15	0.222	2.000
16	0.162	0.500	17	0.243	1.500
18	0.311	0.500	19	0.265	1.500
20	0.133	0.500	21	0.235	1.500
22	0.126	0.500	23	0.224	0.600
24	0.177	0.500	25	0.264	0.600
26	0.159	0.500	27	0.153	0.600
28	0.126	0.500	29	0.212	0.600
30	0.143	0.500	31	0.301	0.600
32	0.227	0.500	33	0.139	0.600
THD	1.324	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(c)	Table: harmonics and waveform distortion (at 33%Pn Phase C, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.197	1.000	03	0.201	4.000
04	0.164	1.000	05	0.510	4.000
06	0.327	1.000	07	0.358	4.000
08	0.167	1.000	09	0.274	4.000
10	0.159	0.500	11	0.336	2.000
12	0.216	0.500	13	0.272	2.000
14	0.156	0.500	15	0.292	2.000
16	0.152	0.500	17	0.207	1.500
18	0.258	0.500	19	0.240	1.500
20	0.149	0.500	21	0.221	1.500
22	0.136	0.500	23	0.192	0.600
24	0.159	0.500	25	0.213	0.600
26	0.157	0.500	27	0.157	0.600
28	0.129	0.500	29	0.221	0.600
30	0.138	0.500	31	0.281	0.600
32	0.242	0.500	33	0.141	0.600
THD	1.323	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(d)	Table: harmonics and waveform distortion (at 66%Pn Phase A, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.098	1.000	03	0.156	4.000
04	0.104	1.000	05	0.163	4.000
06	0.232	1.000	07	0.161	4.000
08	0.095	1.000	09	0.214	4.000
10	0.098	0.500	11	0.115	2.000
12	0.151	0.500	13	0.124	2.000
14	0.091	0.500	15	0.131	2.000
16	0.095	0.500	17	0.085	1.500
18	0.130	0.500	19	0.113	1.500
20	0.078	0.500	21	0.105	1.500
22	0.070	0.500	23	0.074	0.600
24	0.083	0.500	25	0.105	0.600
26	0.075	0.500	27	0.087	0.600
28	0.069	0.500	29	0.093	0.600
30	0.078	0.500	31	0.114	0.600
32	0.088	0.500	33	0.072	0.600
THD	0.665	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(e)	Table: harmonics and waveform distortion (at 66%Pn Phase B, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.114	1.000	03	0.143	4.000
04	0.089	1.000	05	0.114	4.000
06	0.253	1.000	07	0.125	4.000
08	0.085	1.000	09	0.162	4.000
10	0.086	0.500	11	0.094	2.000
12	0.146	0.500	13	0.131	2.000
14	0.088	0.500	15	0.125	2.000
16	0.085	0.500	17	0.079	1.500
18	0.174	0.500	19	0.133	1.500
20	0.078	0.500	21	0.129	1.500
22	0.070	0.500	23	0.081	0.600
24	0.102	0.500	25	0.133	0.600
26	0.079	0.500	27	0.086	0.600
28	0.070	0.500	29	0.088	0.600
30	0.084	0.500	31	0.146	0.600
32	0.110	0.500	33	0.076	0.600
THD	0.664	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(f)	Table: harmonics and waveform distortion (at 66%Pn Phase C, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.113	1.000	03	0.126	4.000
04	0.098	1.000	05	0.189	4.000
06	0.203	1.000	07	0.145	4.000
08	0.096	1.000	09	0.186	4.000
10	0.094	0.500	11	0.118	2.000
12	0.125	0.500	13	0.127	2.000
14	0.092	0.500	15	0.158	2.000
16	0.094	0.500	17	0.091	1.500
18	0.135	0.500	19	0.112	1.500
20	0.085	0.500	21	0.121	1.500
22	0.081	0.500	23	0.082	0.600
24	0.091	0.500	25	0.105	0.600
26	0.086	0.500	27	0.088	0.600
28	0.078	0.500	29	0.101	0.600
30	0.086	0.500	31	0.119	0.600
32	0.120	0.500	33	0.082	0.600
THD	0.667	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(g)	Table: harmonics and waveform distortion (at 100%Pn Phase A, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.167	1.000	03	0.076	4.000
04	0.125	1.000	05	0.126	4.000
06	0.161	1.000	07	0.151	4.000
08	0.092	1.000	09	0.093	4.000
10	0.076	0.500	11	0.154	2.000
12	0.102	0.500	13	0.148	2.000
14	0.082	0.500	15	0.082	2.000
16	0.070	0.500	17	0.114	1.500
18	0.113	0.500	19	0.128	1.500
20	0.074	0.500	21	0.076	1.500
22	0.059	0.500	23	0.131	0.600
24	0.073	0.500	25	0.117	0.600
26	0.063	0.500	27	0.066	0.600
28	0.052	0.500	29	0.091	0.600
30	0.062	0.500	31	0.101	0.600
32	0.061	0.500	33	0.061	0.600
THD	0.587	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(h)	Table: harmonics and waveform distortion (at 100%Pn Phase B, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.181	1.000	03	0.169	4.000
04	0.088	1.000	05	0.109	4.000
06	0.214	1.000	07	0.099	4.000
08	0.086	1.000	09	0.096	4.000
10	0.067	0.500	11	0.126	2.000
12	0.107	0.500	13	0.130	2.000
14	0.076	0.500	15	0.095	2.000
16	0.070	0.500	17	0.106	1.500
18	0.146	0.500	19	0.132	1.500
20	0.069	0.500	21	0.091	1.500
22	0.062	0.500	23	0.123	0.600
24	0.078	0.500	25	0.133	0.600
26	0.069	0.500	27	0.077	0.600
28	0.058	0.500	29	0.085	0.600
30	0.065	0.500	31	0.106	0.600
32	0.070	0.500	33	0.066	0.600
THD	0.611	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(i)	Table: harmonics and waveform distortion (at 100%Pn Phase C, 50Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.103	1.000	03	0.155	4.000
04	0.126	1.000	05	0.156	4.000
06	0.304	1.000	07	0.140	4.000
08	0.092	1.000	09	0.115	4.000
10	0.084	0.500	11	0.135	2.000
12	0.151	0.500	13	0.147	2.000
14	0.088	0.500	15	0.105	2.000
16	0.081	0.500	17	0.108	1.500
18	0.207	0.500	19	0.137	1.500
20	0.079	0.500	21	0.100	1.500
22	0.070	0.500	23	0.124	0.600
24	0.090	0.500	25	0.127	0.600
26	0.074	0.500	27	0.078	0.600
28	0.061	0.500	29	0.086	0.600
30	0.070	0.500	31	0.105	0.600
32	0.076	0.500	33	0.072	0.600
THD	0.698	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(a)	Table: harmonics and waveform distortion (at 33%Pn Phase A, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.173	1.000	03	0.255	4.000
04	0.631	1.000	05	0.212	4.000
06	0.329	1.000	07	0.209	4.000
08	0.172	1.000	09	0.299	4.000
10	0.307	0.500	11	0.154	2.000
12	0.197	0.500	13	0.176	2.000
14	0.279	0.500	15	0.140	2.000
16	0.154	0.500	17	0.120	1.500
18	0.145	0.500	19	0.170	1.500
20	0.123	0.500	21	0.112	1.500
22	0.111	0.500	23	0.121	0.600
24	0.174	0.500	25	0.102	0.600
26	0.100	0.500	27	0.094	0.600
28	0.131	0.500	29	0.114	0.600
30	0.126	0.500	31	0.086	0.600
32	0.084	0.500	33	0.089	0.600
THD	1.169	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(b)	Table: harmonics and waveform distortion (at 33%Pn Phase B, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.271	1.000	03	0.191	4.000
04	0.220	1.000	05	0.520	4.000
06	0.201	1.000	07	0.265	4.000
08	0.158	1.000	09	0.176	4.000
10	0.292	0.500	11	0.275	2.000
12	0.141	0.500	13	0.186	2.000
14	0.175	0.500	15	0.345	2.000
16	0.136	0.500	17	0.148	1.500
18	0.111	0.500	19	0.173	1.500
20	0.188	0.500	21	0.116	1.500
22	0.100	0.500	23	0.110	0.600
24	0.131	0.500	25	0.175	0.600
26	0.096	0.500	27	0.083	0.600
28	0.082	0.500	29	0.132	0.600
30	0.111	0.500	31	0.117	0.600
32	0.077	0.500	33	0.077	0.600
THD	1.113	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(c)	Table: harmonics and waveform distortion (at 33%Pn Phase C, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.252	1.000	03	0.200	4.000
04	0.223	1.000	05	0.571	4.000
06	0.184	1.000	07	0.391	4.000
08	0.161	1.000	09	0.170	4.000
10	0.267	0.500	11	0.287	2.000
12	0.138	0.500	13	0.228	2.000
14	0.167	0.500	15	0.276	2.000
16	0.137	0.500	17	0.149	1.500
18	0.113	0.500	19	0.168	1.500
20	0.172	0.500	21	0.124	1.500
22	0.104	0.500	23	0.121	0.600
24	0.122	0.500	25	0.168	0.600
26	0.102	0.500	27	0.101	0.600
28	0.090	0.500	29	0.152	0.600
30	0.113	0.500	31	0.121	0.600
32	0.093	0.500	33	0.080	0.600
THD	1.157	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(d)	Table: harmonics and waveform distortion (at 66%Pn Phase A, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.318	1.000	03	0.125	4.000
04	0.143	1.000	05	0.316	4.000
06	0.110	1.000	07	0.180	4.000
08	0.103	1.000	09	0.093	4.000
10	0.149	0.500	11	0.221	2.000
12	0.083	0.500	13	0.202	2.000
14	0.085	0.500	15	0.129	2.000
16	0.073	0.500	17	0.168	1.500
18	0.066	0.500	19	0.150	1.500
20	0.089	0.500	21	0.063	1.500
22	0.061	0.500	23	0.146	0.600
24	0.066	0.500	25	0.120	0.600
26	0.056	0.500	27	0.053	0.600
28	0.053	0.500	29	0.084	0.600
30	0.061	0.500	31	0.083	0.600
32	0.050	0.500	33	0.048	0.600
THD	0.768	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(e)	Table: harmonics and waveform distortion (at 66%Pn Phase B, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.202	1.000	03	0.164	4.000
04	0.105	1.000	05	0.285	4.000
06	0.089	1.000	07	0.102	4.000
08	0.080	1.000	09	0.094	4.000
10	0.157	0.500	11	0.172	2.000
12	0.070	0.500	13	0.152	2.000
14	0.087	0.500	15	0.176	2.000
16	0.070	0.500	17	0.146	1.500
18	0.060	0.500	19	0.140	1.500
20	0.095	0.500	21	0.061	1.500
22	0.053	0.500	23	0.144	0.600
24	0.063	0.500	25	0.123	0.600
26	0.049	0.500	27	0.047	0.600
28	0.043	0.500	29	0.087	0.600
30	0.055	0.500	31	0.081	0.600
32	0.041	0.500	33	0.041	0.600
THD	0.668	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(f)	Table: harmonics and waveform distortion (at 66%Pn Phase C, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.244	1.000	03	0.123	4.000
04	0.113	1.000	05	0.282	4.000
06	0.095	1.000	07	0.167	4.000
08	0.085	1.000	09	0.093	4.000
10	0.145	0.500	11	0.193	2.000
12	0.074	0.500	13	0.196	2.000
14	0.080	0.500	15	0.150	2.000
16	0.070	0.500	17	0.149	1.500
18	0.062	0.500	19	0.159	1.500
20	0.084	0.500	21	0.067	1.500
22	0.060	0.500	23	0.134	0.600
24	0.064	0.500	25	0.127	0.600
26	0.054	0.500	27	0.053	0.600
28	0.049	0.500	29	0.083	0.600
30	0.056	0.500	31	0.082	0.600
32	0.049	0.500	33	0.043	0.600
THD	0.700	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(g)	Table: harmonics and waveform distortion (at 100%Pn Phase A, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.157	1.000	03	0.077	4.000
04	0.119	1.000	05	0.151	4.000
06	0.083	1.000	07	0.125	4.000
08	0.071	1.000	09	0.055	4.000
10	0.075	0.500	11	0.146	2.000
12	0.054	0.500	13	0.146	2.000
14	0.053	0.500	15	0.088	2.000
16	0.045	0.500	17	0.106	1.500
18	0.044	0.500	19	0.100	1.500
20	0.048	0.500	21	0.043	1.500
22	0.039	0.500	23	0.116	0.600
24	0.039	0.500	25	0.096	0.600
26	0.037	0.500	27	0.035	0.600
28	0.032	0.500	29	0.069	0.600
30	0.032	0.500	31	0.059	0.600
32	0.031	0.500	33	0.029	0.600
THD	0.479	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(h)	Table: harmonics and waveform distortion (at 100%Pn Phase B, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.152	1.000	03	0.110	4.000
04	0.099	1.000	05	0.188	4.000
06	0.077	1.000	07	0.068	4.000
08	0.062	1.000	09	0.059	4.000
10	0.088	0.500	11	0.125	2.000
12	0.051	0.500	13	0.105	2.000
14	0.062	0.500	15	0.117	2.000
16	0.046	0.500	17	0.085	1.500
18	0.041	0.500	19	0.086	1.500
20	0.053	0.500	21	0.040	1.500
22	0.038	0.500	23	0.112	0.600
24	0.043	0.500	25	0.099	0.600
26	0.036	0.500	27	0.033	0.600
28	0.033	0.500	29	0.064	0.600
30	0.034	0.500	31	0.060	0.600
32	0.030	0.500	33	0.029	0.600
THD	0.464	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.6(i)	Table: harmonics and waveform distortion (at 100%Pn Phase C, 60Hz)				P
Harmonic	**% of fundamental**	**Limits (% of fundamental)**	**Harmonic**	**% of fundamental**	**Limits (% of fundamental)**
02	0.063	1.000	03	0.098	4.000
04	0.081	1.000	05	0.238	4.000
06	0.070	1.000	07	0.109	4.000
08	0.060	1.000	09	0.061	4.000
10	0.106	0.500	11	0.127	2.000
12	0.051	0.500	13	0.141	2.000
14	0.054	0.500	15	0.160	2.000
16	0.046	0.500	17	0.095	1.500
18	0.042	0.500	19	0.104	1.500
20	0.059	0.500	21	0.046	1.500
22	0.040	0.500	23	0.104	0.600
24	0.041	0.500	25	0.107	0.600
26	0.036	0.500	27	0.039	0.600
28	0.033	0.500	29	0.061	0.600
30	0.035	0.500	31	0.065	0.600
32	0.033	0.500	33	0.028	0.600
THD	0.499	5.000	--	--	--
Supplementary information:					

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

4.7	TABLE: Power factor	P

50Hz

	Input			Output					
No	**Voltage (V d.c.)**	**Current (A d.c.)**	**Power (KW)**	**Voltage (V a.c.)**	**Current (A a.c.)**	**Power (KW)**	**Power factor**		**Rated output (V.A)**
1	741.7	28.6	21.1	230.2	30.1	20.6	a b c	0.992 0.993 N/A	(20±5)%
3	745.1	41.2	30.6	230.2	43.5	29.9	a b c	0.995 0.996 N/A	(30±5)%
3	745.9	55.2	41.2	230.2	58.4	40.2	a b c	0.997 0.998 N/A	(40±5)%
4	747.5	69.3	51.7	230.3	73.3	50.5	a b c	0.998 0.999 N/A	(50±5)%
5	746.3	83.5	62.3	230.3	88.1	60.8	a b c	0.998 0.999 N/A	(60±5)%
6	746.9	115.3	87.4	230.3	88.2	70.0	a b c	0.998 0.999 N/A	(70±5)%
7	746.3	110.2	82.2	230.3	116.1	80.1	a b c	0.998 0.999 N/A	(80±5)%
8	746.9	124.2	92.8	230.4	130.8	90.3	a b c	0.998 0.999 N/A	(90±5)%
9	786.9	130.6	102.7	230.4	144.7	99.8	a b c	0.999 0.999 N/A	(100±5)%

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

Each power stage has been maintained during 120 seconds for measurements with a sampling rate of 0.2 s.
Values offered correspond with the 120s average measured with each corresponding stage.
Except for power factor measurements, where:
The value a) indicates the average of measured absolute PF values during each 120s stage of measurement.
The value b) indicates the maximum leading PF value measured during each 120s stage of measurement.
The value c) indicates the maximum lagging PF value measured during each 120s stage of measurement.

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

60Hz									
	Input			Output					
No	Voltage (V d.c.)	Current (A d.c.)	Power (KW)	Voltage (V a.c.)	Current (A a.c.)	Power (KW)	Power factor		Rated output (V.A)
1	742.4	28.6	21.1	220.2	31.4	20.6	a	0.991	(20±5)%
							b	0.992	
							c	N/A	
3	744.4	41.2	30.6	220.2	45.4	29.9	a	0.996	(30±5)%
							b	0.996	
							c	N/A	
3	746.7	55.2	41.2	220.3	61.0	40.2	a	0.997	(40±5)%
							b	0.997	
							c	N/A	
4	746.4	69.3	51.7	220.3	76.4	50.4	a	0.999	(50±5)%
							b	0.999	
							c	N/A	
5	746.5	83.4	62.2	220.3	91.9	60.7	a	0.999	(60±5)%
							b	0.999	
							c	N/A	
6	745.5	116.1	87.9	220.3	92.0	70.8	a	0.999	(70±5)%
							b	0.999	
							c	N/A	
7	745.2	111.8	83.3	220.4	122.6	81.0	a	0.999	(80±5)%
							b	0.999	
							c	N/A	
8	745.1	124.5	92.7	220.4	136.5	90.1	a	0.999	(90±5)%
							b	0.999	
							c	N/A	
9	787.3	130.5	102.7	220.4	150.9	99.7	a	0.999	(100±5)%
							b	0.999	
							c	N/A	

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

Each power stage has been maintained during 120 seconds for measurements with a sampling rate of 0.2 s.
Values offered correspond with the 120s average measured with each corresponding stage.
Except for power factor measurements, where:
The value a) indicates the average of measured absolute PF values during each 120s stage of measurement.
The value b) indicates the maximum leading PF value measured during each 120s stage of measurement.
The value c) indicates the maximum lagging PF value measured during each 120s stage of measurement.

IEC 61727			
Clause	Requirement + Test	Result - Remark	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 (ms)	Measured tripped voltage (V)	Measured disconnection time (ms)
50 % Vn≤ V < 85 % Vn Phase ABC							
230	100000	195.5	195.5	--	2000	194.7	1614
230	100000	155	155	--	2000	154.8	1610
230	100000	117	117	--	2000	115.7	1620
V < 50%Vn Phase ABC							
230	100000	114	114	--	100	113.5	89

(2) Under voltage reconnection procedure

Ratio of voltage rapidly decreased (V / s)	Reconnection voltage (V)	Reconnection time (s)
--	198.1	112.4

(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 (ms)	Measured tripped voltage (V)	Measured disconnection time (ms)
110 % Vn < V < 135 % Vn Phase ABC							
230	100000	253	255	--	2000	254.6	1326
230	100000	282	282	--	2000	281.5	1348
230	100000	309	309	--	2000	307.4	1641
135 % Vn≤ V Phase ABC							
230	100000	312	312	--	50	310.4	42

(4) Over voltage reconnection procedure

Ratio of voltage rapidly decreased (V / s)	Reconnection voltage (V)	Reconnection time (s)
--	249.6	129.4

Supplementary information:

N/A

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

(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 (ms)**	**Measured tripped voltage (V)**	**Measured disconnection time (ms)**
50 % Vn≤ V < 85 % Vn Phase ABC							
220	100000	186	186	--	2000	184.8	1609
220	100000	149	149	--	2000	147.7	1973
220	100000	111	111	--	2000	109.7	1607
V < 50%Vn Phase ABC							
220	100000	109	109	--	100	107.6	79

(2) Under voltage reconnection procedure		
Ratio of voltage rapidly decreased (V / s)	**Reconnection voltage (V)**	**Reconnection time (s)**
--	189.1	138.2

(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 (ms)**	**Measured tripped voltage (V)**	**Measured disconnection time (ms)**
110 % Vn < V < 135 % Vn Phase ABC							
220	100000	241	241	--	2000	241.8	1626
220	100000	270	270	--	2000	268.5	1946
220	100000	296	296	--	2000	294.5	1612
135 % Vn≤ V Phase ABC							
220	100000	298	298	--	50	296.4	24

(4) Over voltage reconnection procedure		
Ratio of voltage rapidly decreased (V / s)	**Reconnection voltage (V)**	**Reconnection time (s)**
--	240.0	149.6

Supplementary information:

N/A

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

5.2.2 & 5.4	TABLE: Over/under frequency trip settings and reconnection test	Pass

(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 (ms)	Measured tripped frequency (Hz)	Measured disconnection time (ms)
50	100000	49	49	--	200	49.0	163

(2) Under frequency reconnection procedure

Ratio of voltage rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
--	49.1	117.2

(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 (ms)	Measured tripped frequency (Hz)	Measured disconnection time (ms)
50	100000	51	51	--	200	51.0	188

(4) Over frequency reconnection procedure

Ratio of voltage rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
--	50.9	76

(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 (ms)	Measured tripped frequency (Hz)	Measured disconnection time (ms)
60	100000	59	59	--	200	58.9	90

(2) Under frequency reconnection procedure

Ratio of voltage rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
--	59.1	141

(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 (ms)	Measured tripped frequency (Hz)	Measured disconnection time (ms)
60	100000	61	61	--	200	61.1	57

(4) Over frequency reconnection procedure

Ratio of voltage rapidly decreased (Hz / s)	Reconnection frequency (Hz)	Reconnection time (s)
--	60.9	139

Supplementary information:

N/A

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

5.3	Table: tested condition and run-on time								P
50Hz									
No.	P_{EUT} (% of EUT rating)	Reactive load (% of normial)	P_{AC}	Q_{AC}	Run-on time(ms)	P_{EUT} (KW)	Actual Q_f	V_{DC} (d.c.V)	Which load is selected to be adjusted (R or L)
Test condtion A									
1	100	100	0	0	488	102.1	1.00	796.1	--
2	100	100	-5	-5	367	101.8	1.02	796.2	R/L
3	100	100	-5	0	437	101.5	1.04	797.1	R
4	100	100	-5	+5	353	101.4	1.05	797.5	R/L
5	100	100	0	-5	431	101.7	0.97	797.2	L
6	100	100	0	+5	395	101.0	1.02	797.4	L
7	100	100	+5	-5	381	102.0	0.95	798.5	R/L
8	100	100	+5	0	419	101.9	0.95	797.3	R
9	100	100	+5	+5	404	101.6	0.97	798.2	R/L
10	100	100	-10	+10	--	--	--	--	R/L
11	100	100	-5	+10	--	--	--	--	R/L
12	100	100	0	+10	--	--	--	--	L
13	100	100	+10	+10	--	--	--	--	R/L
14	100	100	+10	+5	--	--	--	--	R/L
15	100	100	+10	0	--	--	--	--	R
16	100	100	+10	-5	--	--	--	--	R/L
17	100	100	+10	-10	--	--	--	--	R/L
18	100	100	+5	-10	--	--	--	--	R/L
19	100	100	+5	10	--	--	--	--	R/L
20	100	100	0	-10	--	--	--	--	L
21	100	100	-5	-10	--	--	--	--	R/L
22	100	100	-10	-10	--	--	--	--	R/L
23	100	100	-10	-5	--	--	--	--	R/L
24	100	100	-10	0	--	--	--	--	R/L

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

25	100	100	-10	+5	--	--	--	--	R/L
Test condtion B									
10	66	66	0	0	460	65.2	1.00	588.8	--
11	66	66	0	-5	105	65.4	0.98	588.3	L
12	66	66	0	-4	278	65.8	0.98	588.5	L
13	66	66	0	-3	397	65.6	0.99	588.7	L
14	66	66	0	-2	471	65.0	0.99	589.1	L
15	66	66	0	-1	460	65.4	1.00	589.5	L
16	66	66	0	1	460	65.3	1.00	588.6	L
17	66	66	0	2	468	65.7	0.99	589.4	L
18	66	66	0	3	142	65.5	0.98	589.2	L
19	66	66	0	4	318	65.4	0.98	589.8	L
20	66	66	0	5	70	65.6	0.98	589.3	L
21	66	66	0	6	--	--	--	--	L
Test condition C									
22	33	33	0	0	390	32.7	1.00	335.4	--
23	33	33	0	-5	197	32.9	0.98	335.2	L
24	33	33	0	-4	259	33.1	0.98	335.7	L
25	33	33	0	-3	487	33.2	0.99	335.1	L
26	33	33	0	-2	394	32.8	0.99	335.0	L
27	33	33	0	-1	387	32.5	1.00	334.9	L
28	33	33	0	1	493	32.9	1.01	335.5	L
29	33	33	0	2	356	33.0	1.01	335.8	L
30	33	33	0	3	466	33.4	1.02	334.8	L
31	33	33	0	4	488	33.1	1.02	335.5	L
32	33	33	0	5	409	32.8	1.03	335.2	L
33	33	33	0	6	--	--	--	--	L

IEC 61727			
Clause	Requirement + Test	Result - Remark	Verdict

60Hz									
No.	P_{EUT} (% of EUT rating)	Reactive load (% of normial)	P_{AC}	Q_{AC}	Run-on time(ms)	P_{EUT} (KW)	Actual Q_f	V_{DC} (d.c.V)	Which load is selected to be adjusted (R or L)
Test condtion A									
1	100	100	0	0	417	101.1	1.00	796.5	--
2	100	100	-5	-5	325	101.0	1.03	796.8	R/L
3	100	100	-5	0	363	100.9	1.05	797.0	R
4	100	100	-5	+5	343	100.5	1.05	797.3	R/L
5	100	100	0	-5	289	101.0	0.98	796.7	L
6	100	100	0	+5	393	101.4	1.03	797.1	L
7	100	100	+5	-5	330	101.5	0.95	797.2	R/L
8	100	100	+5	0	352	100.6	0.95	797.4	R
9	100	100	+5	+5	324	101.7	0.98	798.1	R/L
10	100	100	-10	+10	--	--	--	--	R/L
11	100	100	-5	+10	--	--	--	--	R/L
12	100	100	0	+10	--	--	--	--	L
13	100	100	+10	+10	--	--	--	--	R/L
14	100	100	+10	+5	--	--	--	--	R/L
15	100	100	+10	0	--	--	--	--	R
16	100	100	+10	-5	--	--	--	--	R/L
17	100	100	+10	-10	--	--	--	--	R/L
18	100	100	+5	-10	--	--	--	--	R/L
19	100	100	+5	10	--	--	--	--	R/L
20	100	100	0	-10	--	--	--	--	L
21	100	100	-5	-10	--	--	--	--	R/L
22	100	100	-10	-10	--	--	--	--	R/L
23	100	100	-10	-5	--	--	--	--	R/L
24	100	100	-10	0	--	--	--	--	R/L
25	100	100	-10	+5	--	--	--	--	R/L
Test condtion B									

IEC 61727									
Clause	Requirement + Test					Result - Remark			Verdict
10	66	66	0	0	308	66.2	1.00	588.4	--
11	66	66	0	-5	309	66.4	0.97	588.8	L
12	66	66	0	-4	365	66.3	0.98	589.1	L
13	66	66	0	-3	333	65.8	0.99	588.6	L
14	66	66	0	-2	332	65.7	0.99	589.3	L
15	66	66	0	-1	284	65.9	1.00	589.1	L
16	66	66	0	1	374	66.3	1.01	588.5	L
17	66	66	0	2	349	65.9	1.01	589.7	L
18	66	66	0	3	390	66.3	1.02	589.0	L
19	66	66	0	4	396	66.4	1.02	589.4	L
20	66	66	0	5	329	65.8	1.02	589.9	L
21	66	66	0	6	--	--	--	--	L
Test condition C									
22	33	33	0	0	416	33.2	1.00	334.8	--
23	33	33	0	-5	327	33.2	0.97	334.6	L
24	33	33	0	-4	345	33.2	0.98	335.2	L
25	33	33	0	-3	407	33.2	0.99	335.4	L
26	33	33	0	-2	296	33.2	0.99	334.9	L
27	33	33	0	-1	390	33.2	1.00	334.7	L
28	33	33	0	1	351	33.2	1.00	335.3	L
29	33	33	0	2	354	33.2	1.01	335.5	L
30	33	33	0	3	428	33.2	1.02	334.6	L
31	33	33	0	4	324	33.2	1.02	335.3	L
32	33	33	0	5	163	33.2	1.03	335.1	L
33	33	33	0	6	--	--	--	--	L

Remark:
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.
The compliances with these requirements are stated in the following test report:
IEC 62116: test report nº GZES201103204502

--- End of test report---

Attachment I

(Pictures of the EUT and Electrical Schemes)

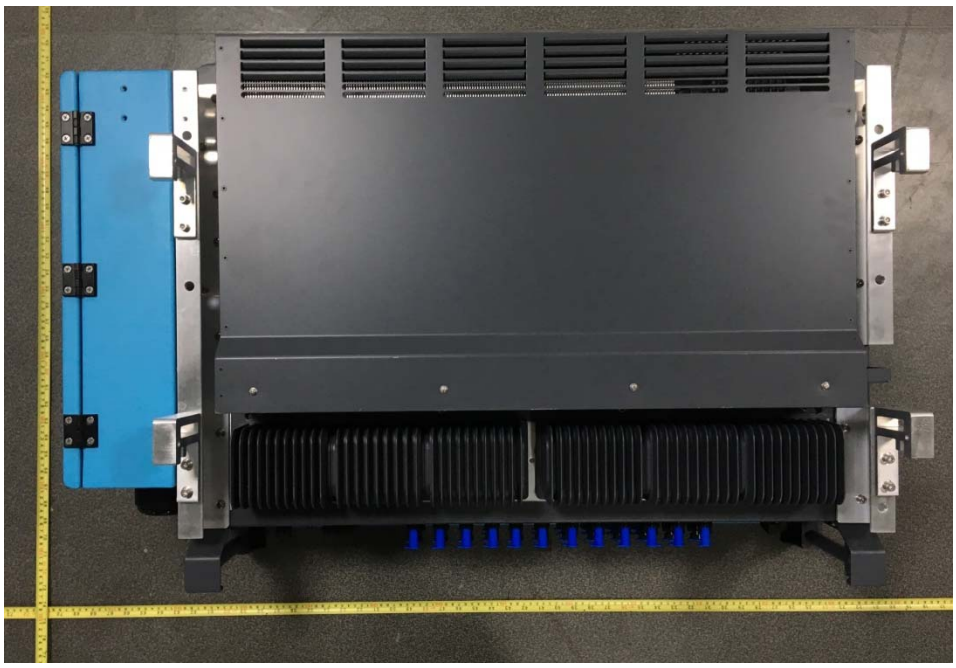
1 PICTURES

Front view

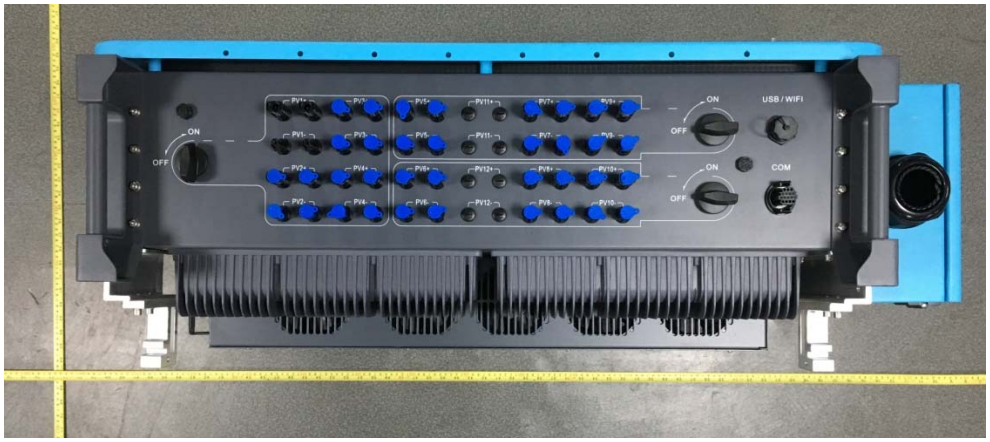

Back view (E-75KTL, E-80KTL)


Back view (E- 100KTL, E- 100KTL-HV, E-110KTL, E- 125KTL-HV)

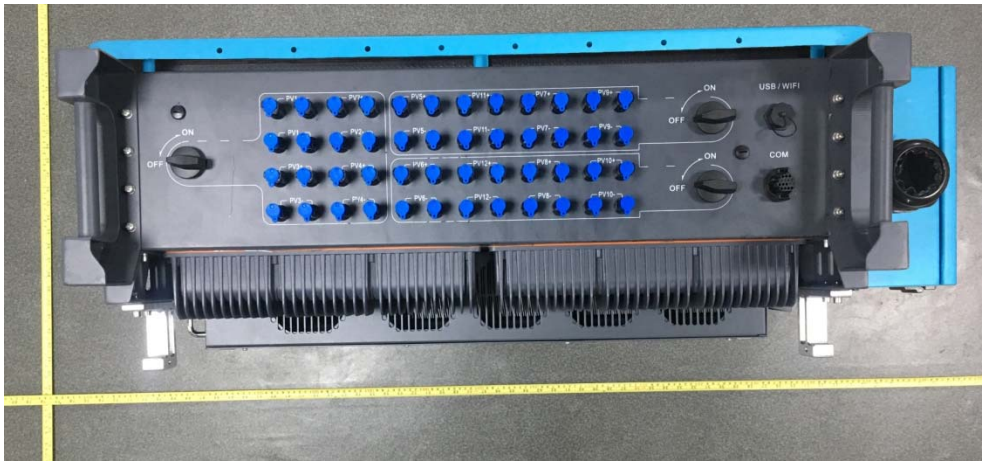
Back view (E- 136KTL-HV)



DC Connection interface (E-75KTL, E-80KTL)

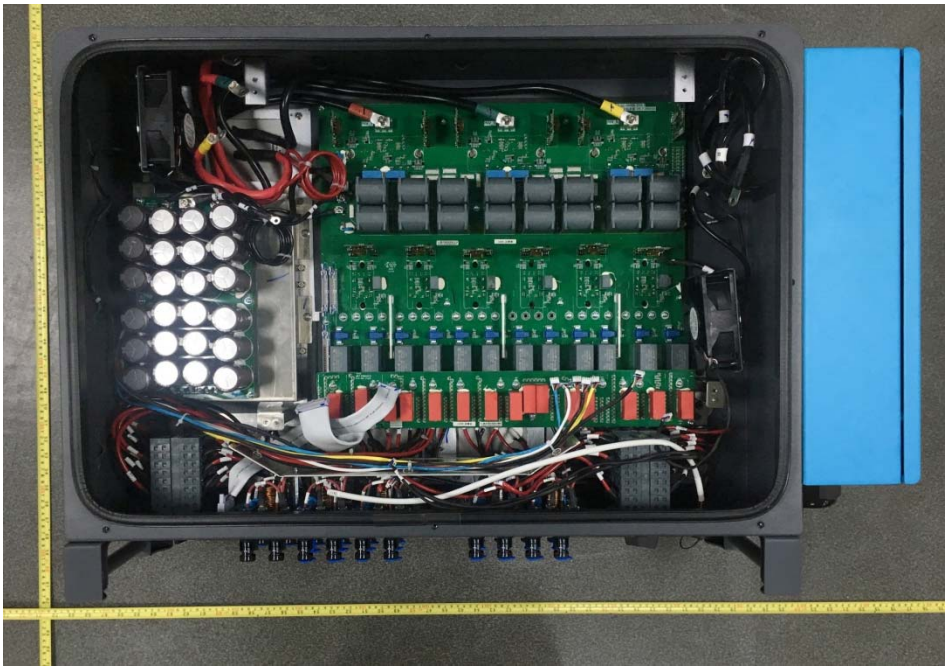

DC Connection interface (E-100KTL, E-100KTL-HV, E-110KTL, E-125KTL-HV)


DC Connection interface (E-136KTL-HV)

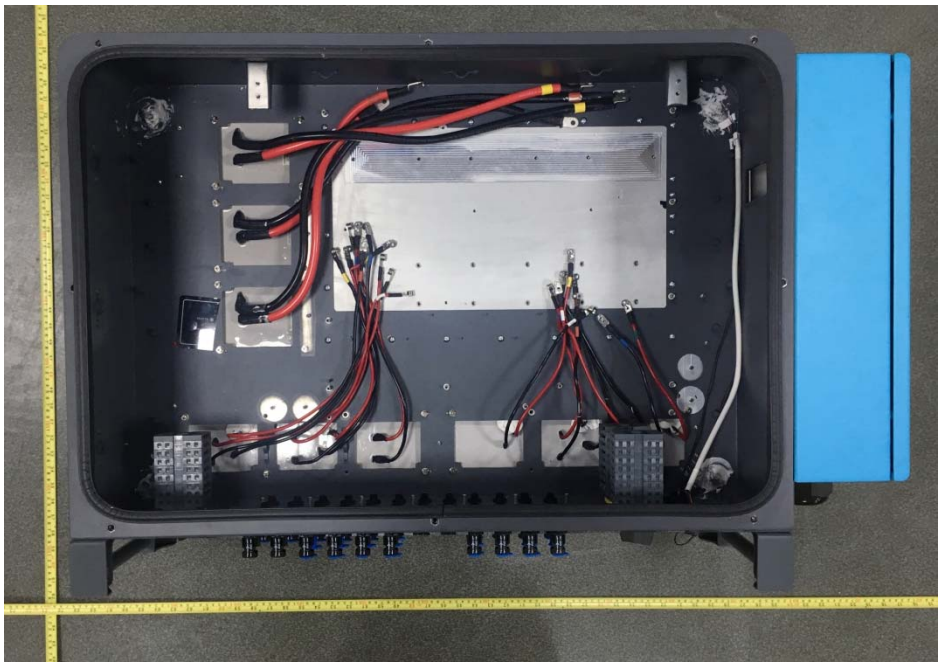


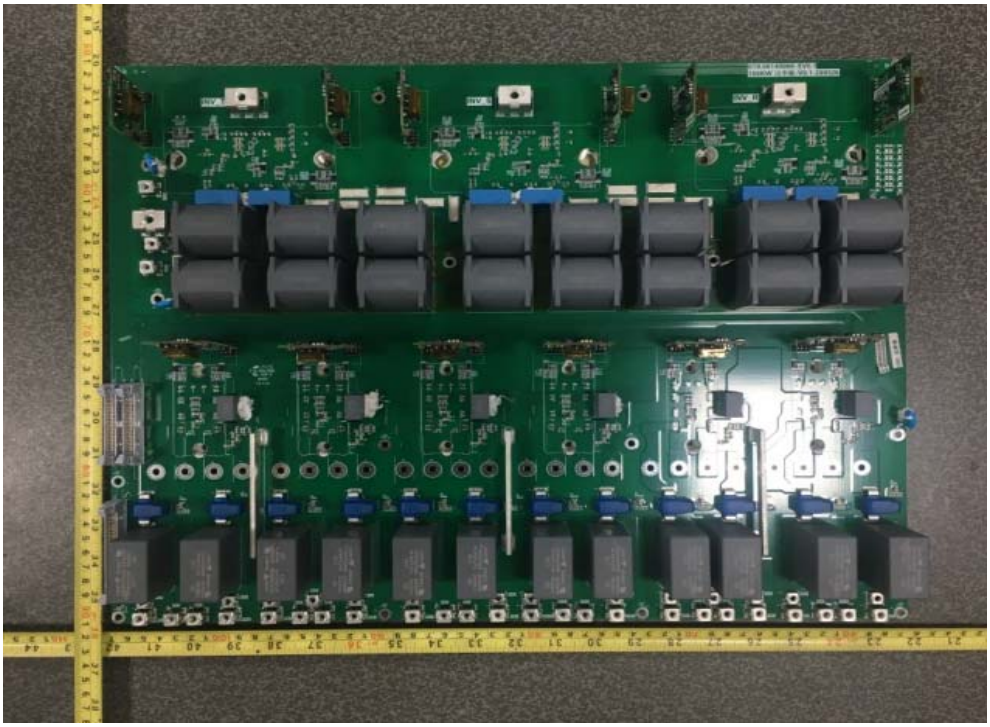
Internal View 1

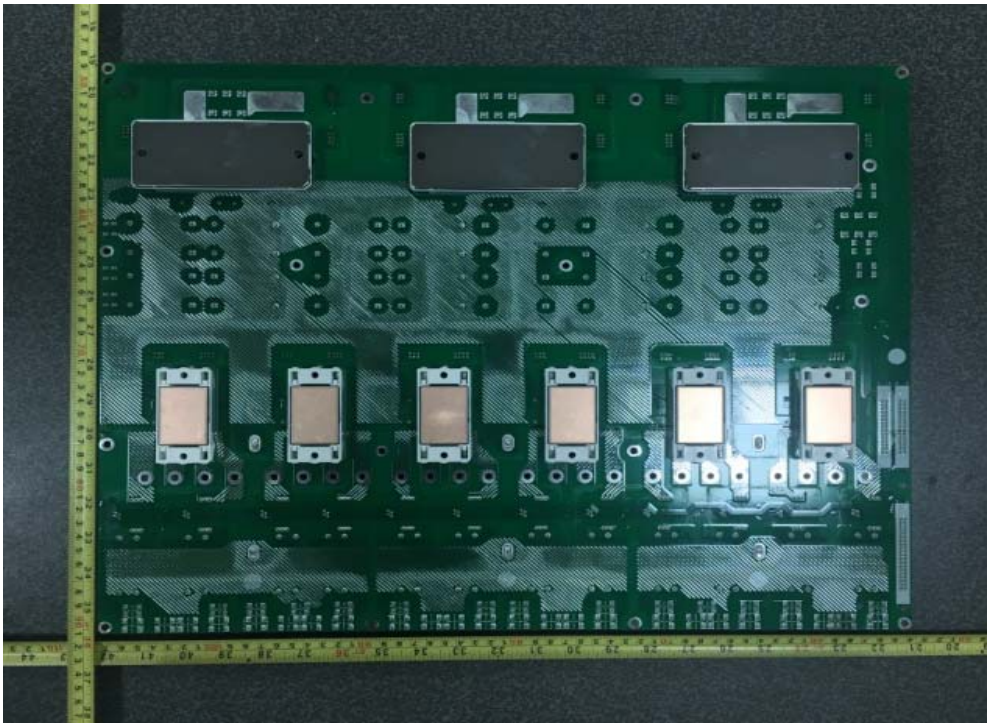
Internal View 2

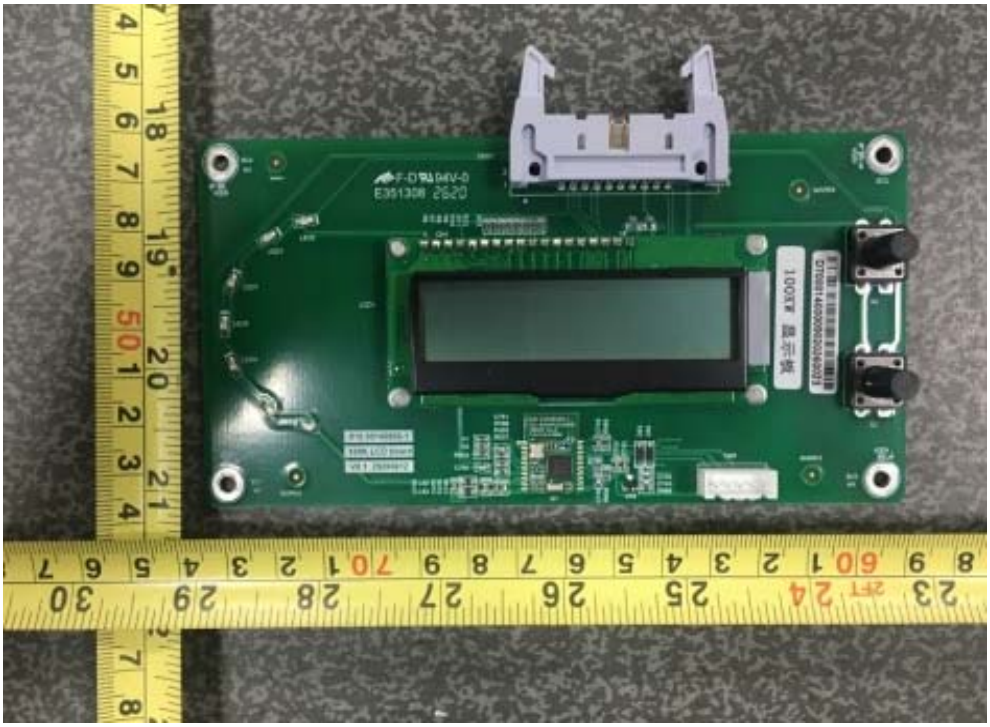


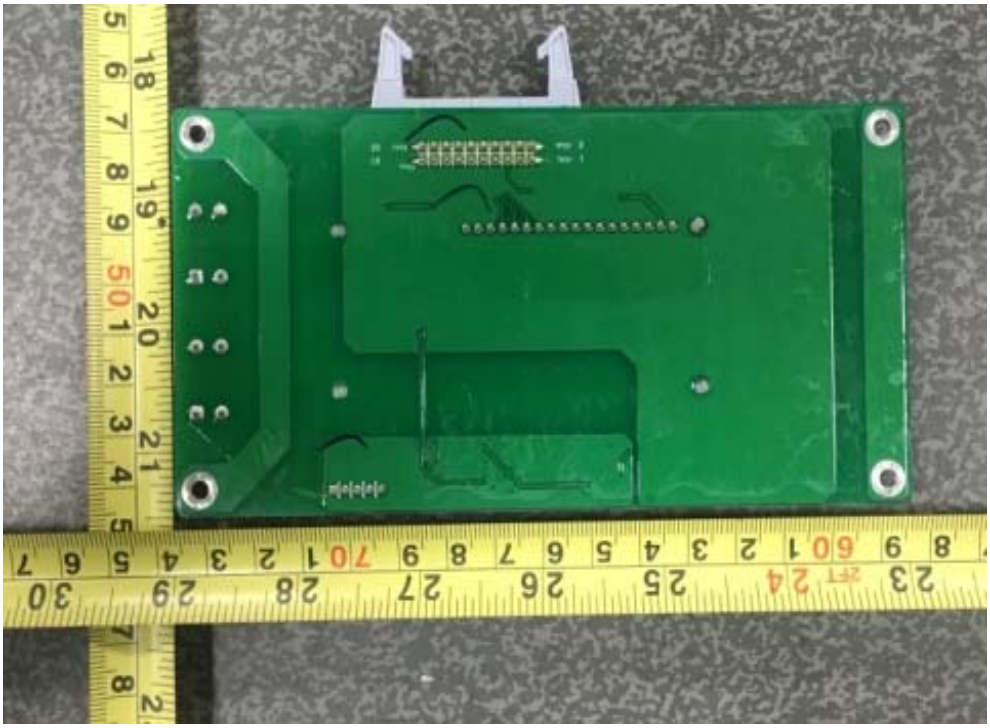
Internal View 3



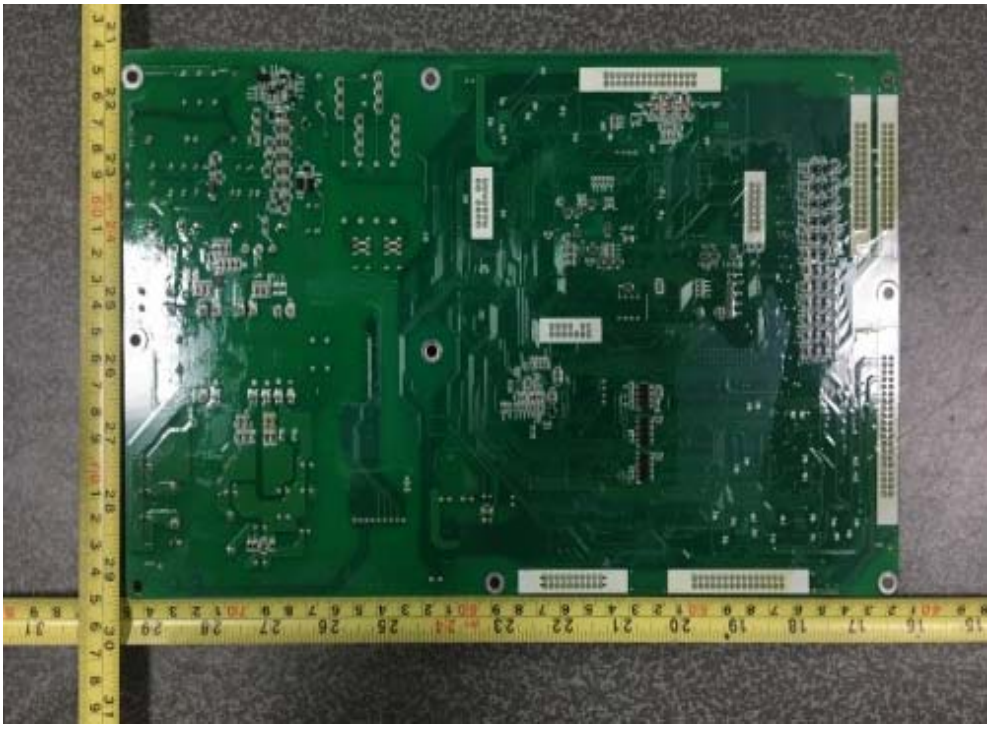
Front side of Power board


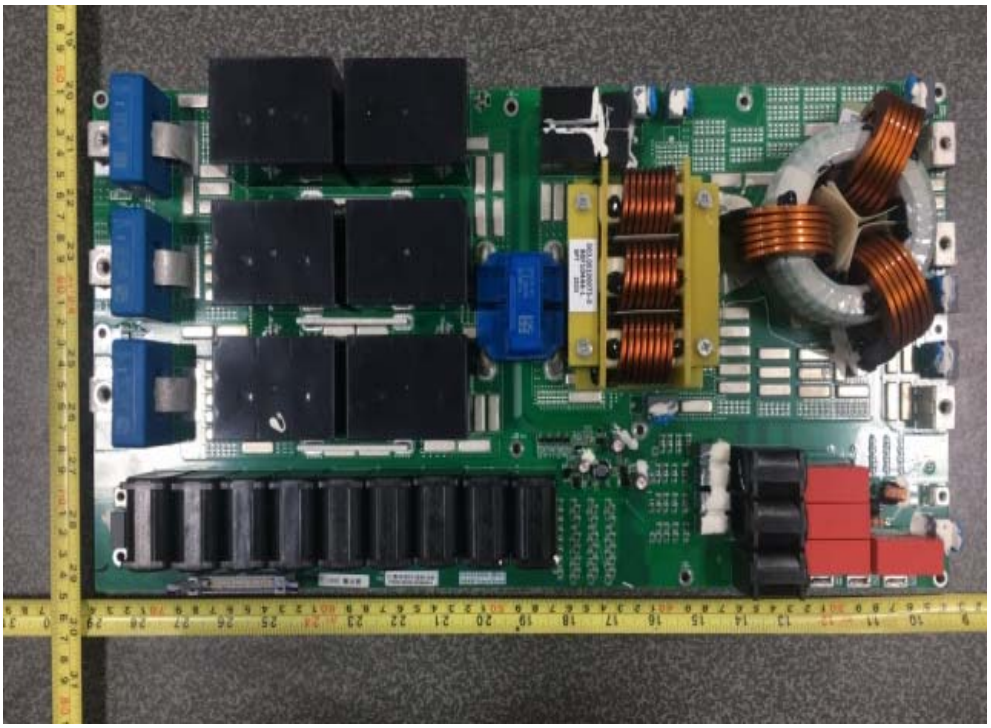
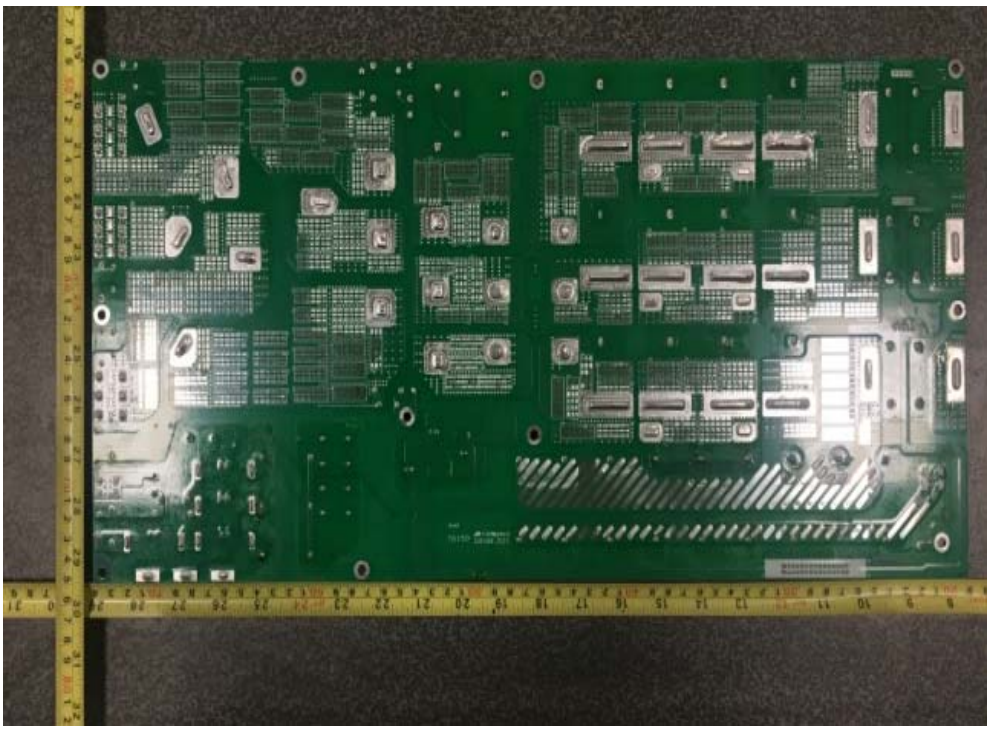
Back side of Power board


Front side of Display board


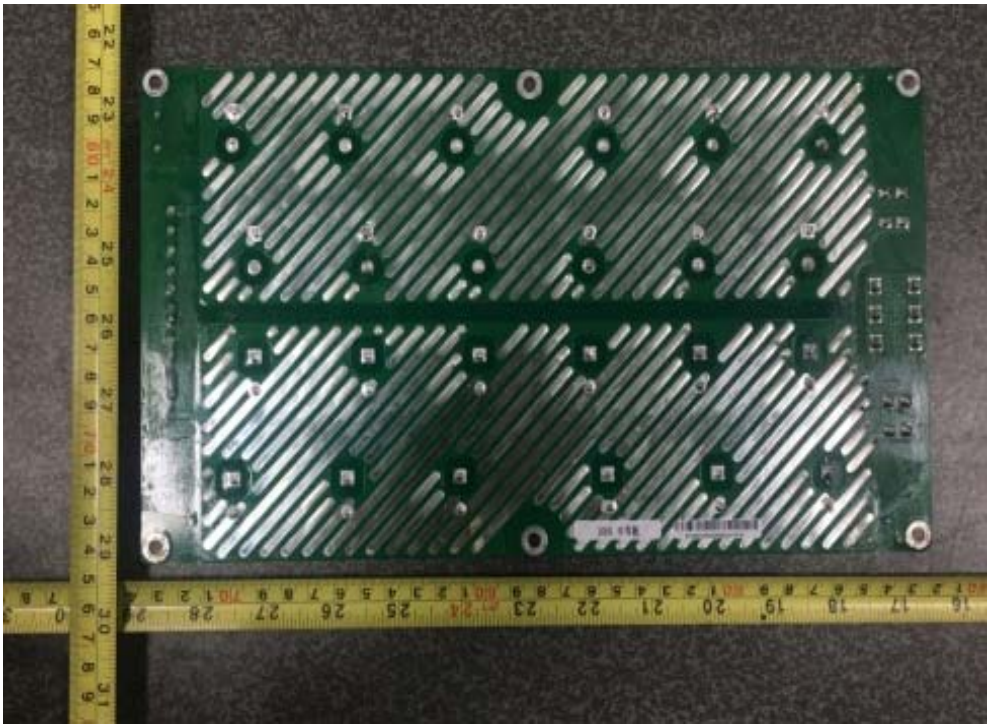
Back side of Display board


Front side of Control board

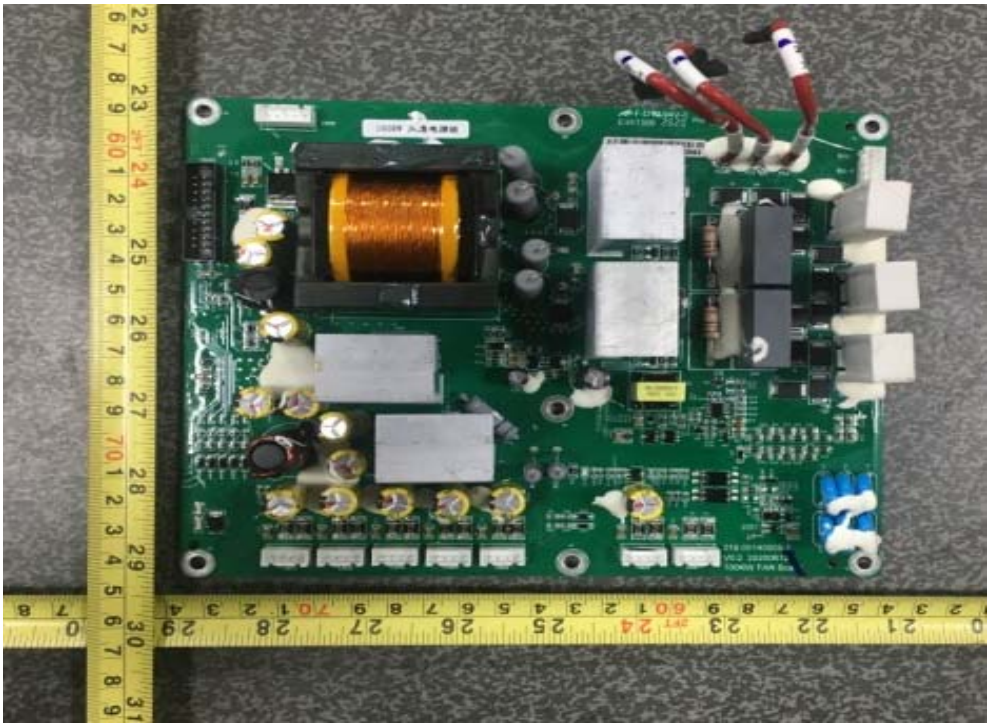

Back side of Control board


Front side of output board

Back side of output board


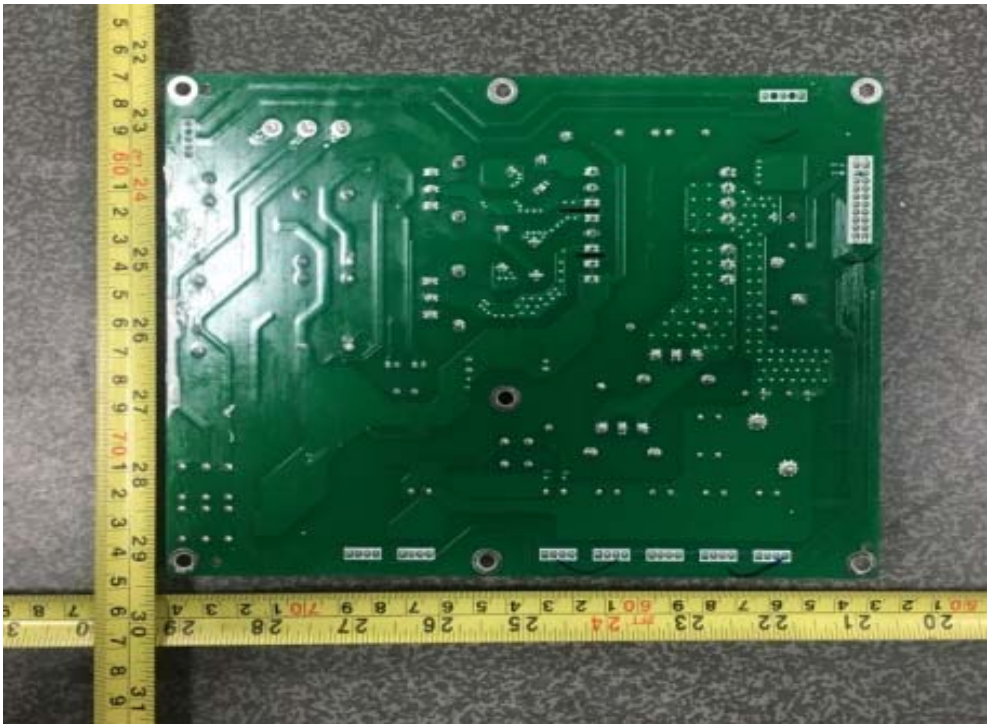
Front side of BUS Capacitor plate

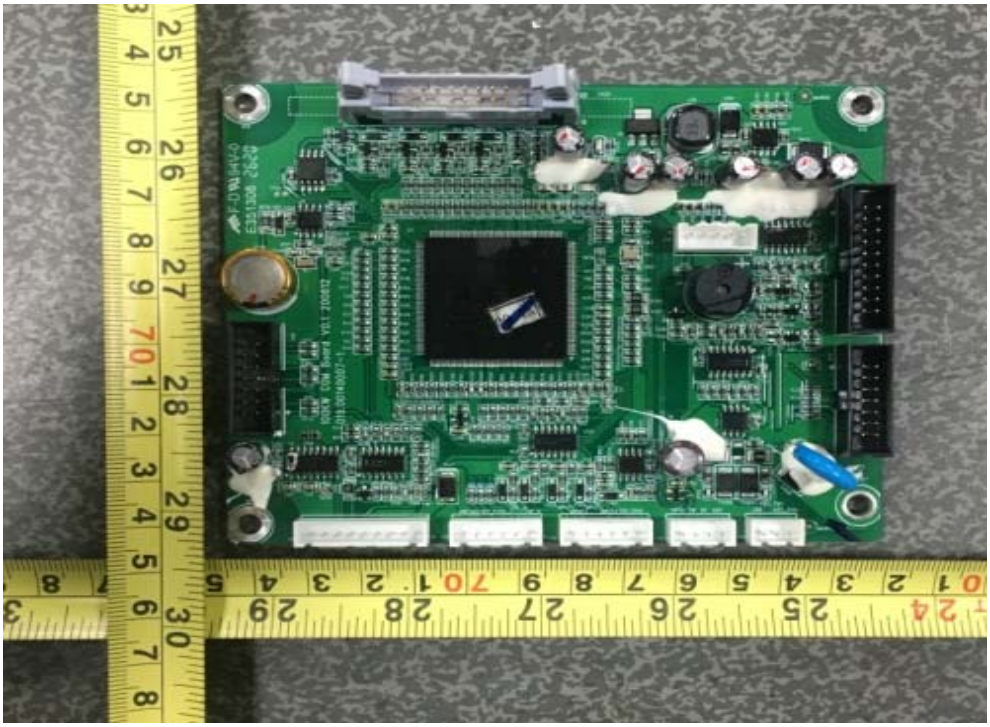
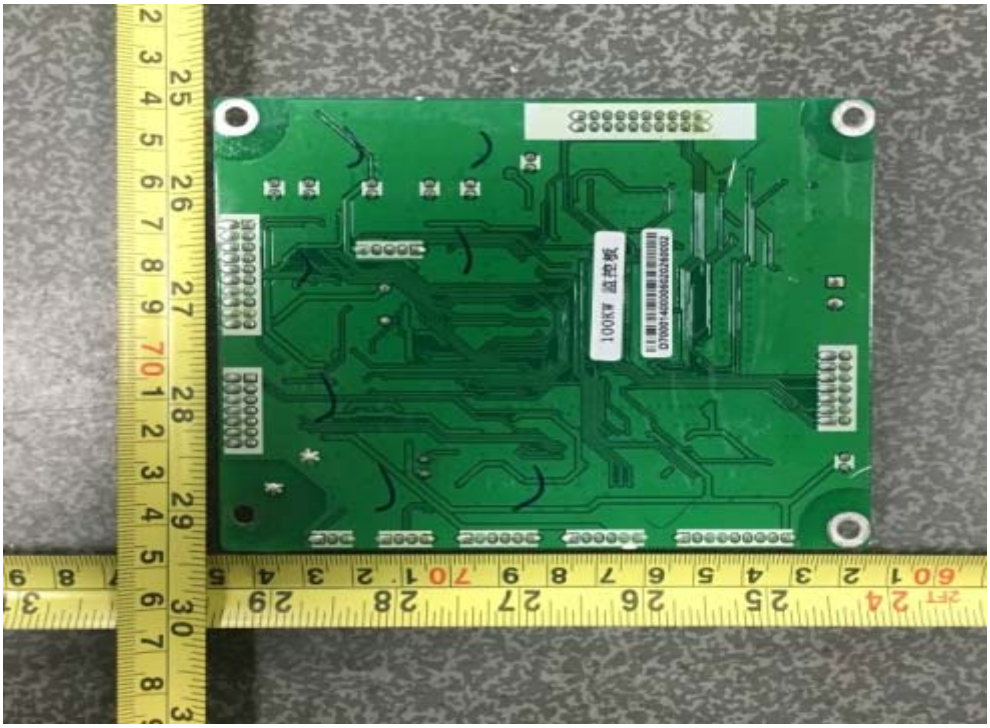
Back side of BUS Capacitor plate


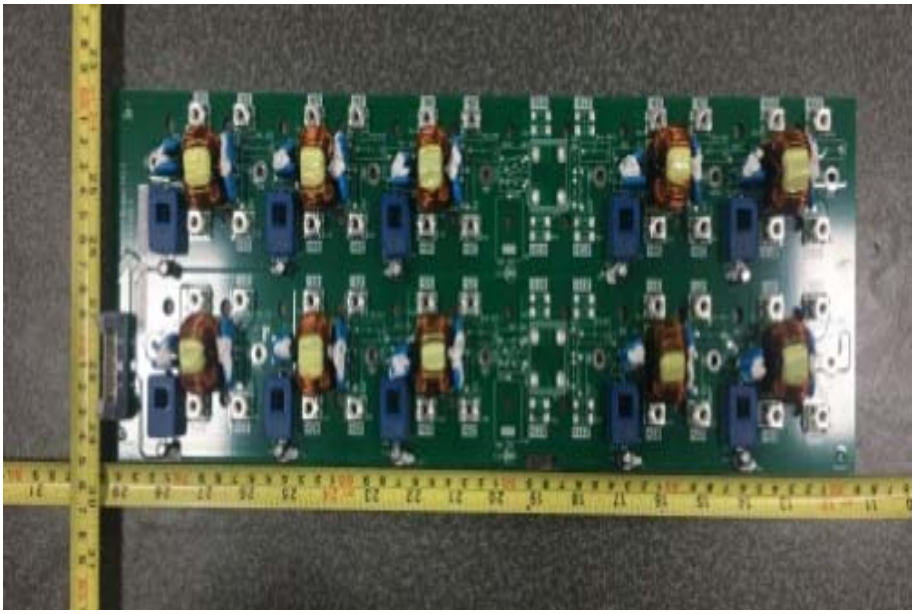
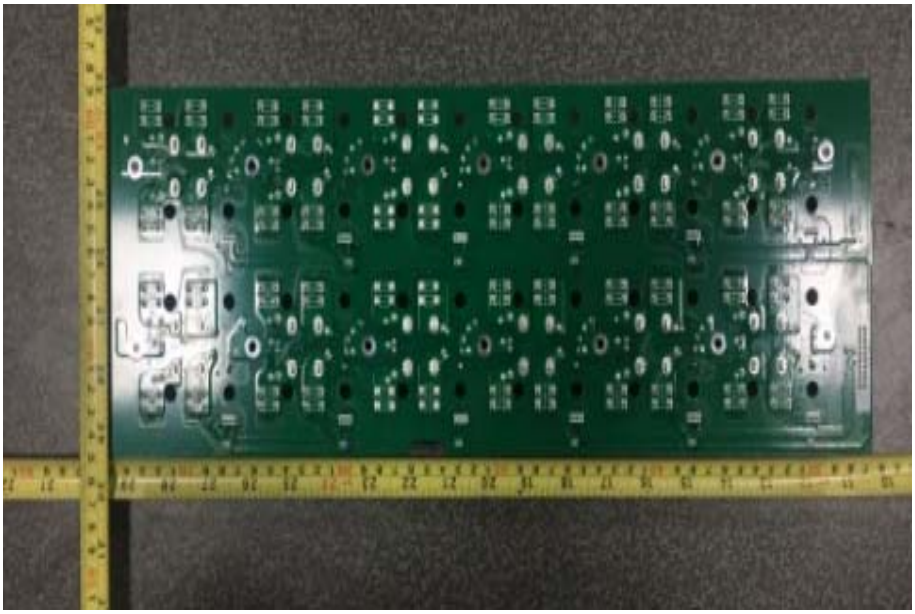
Front side of power supply board

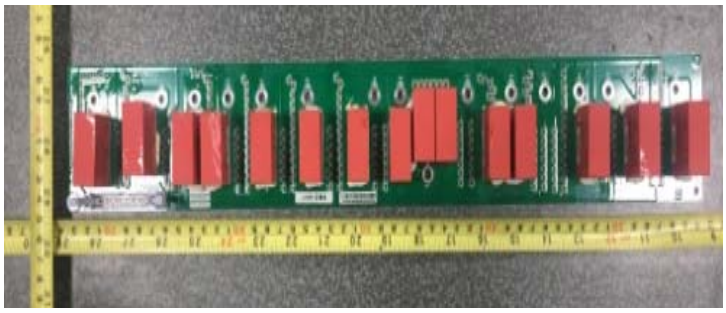
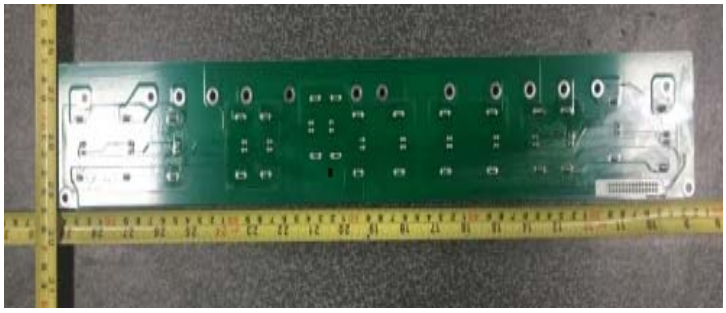


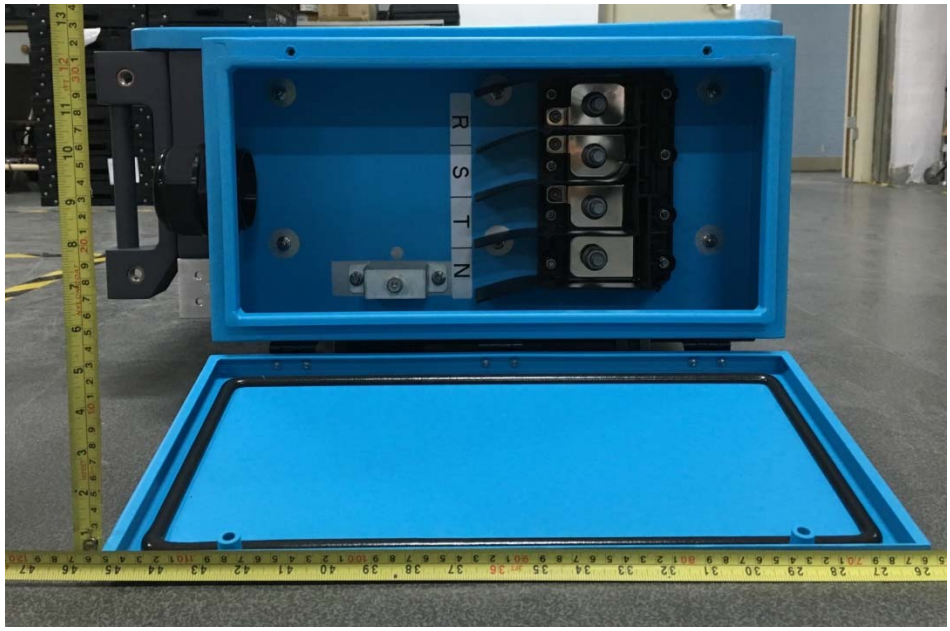
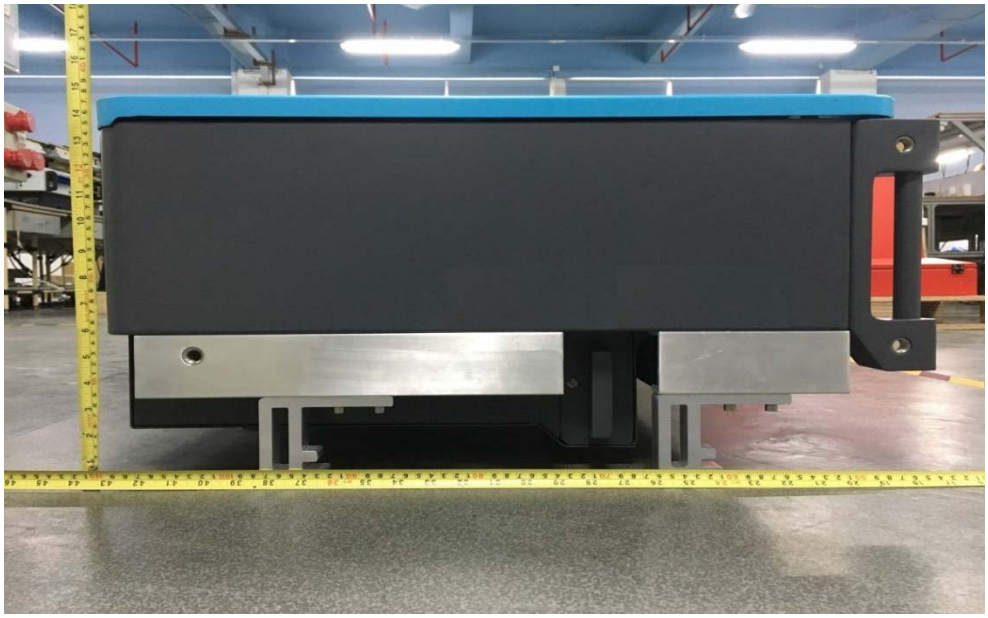
Back side of power supply board



Front side of Communication board

Back side of Communication board


Front side of EMI input filter board

Back side of EMI input filter board


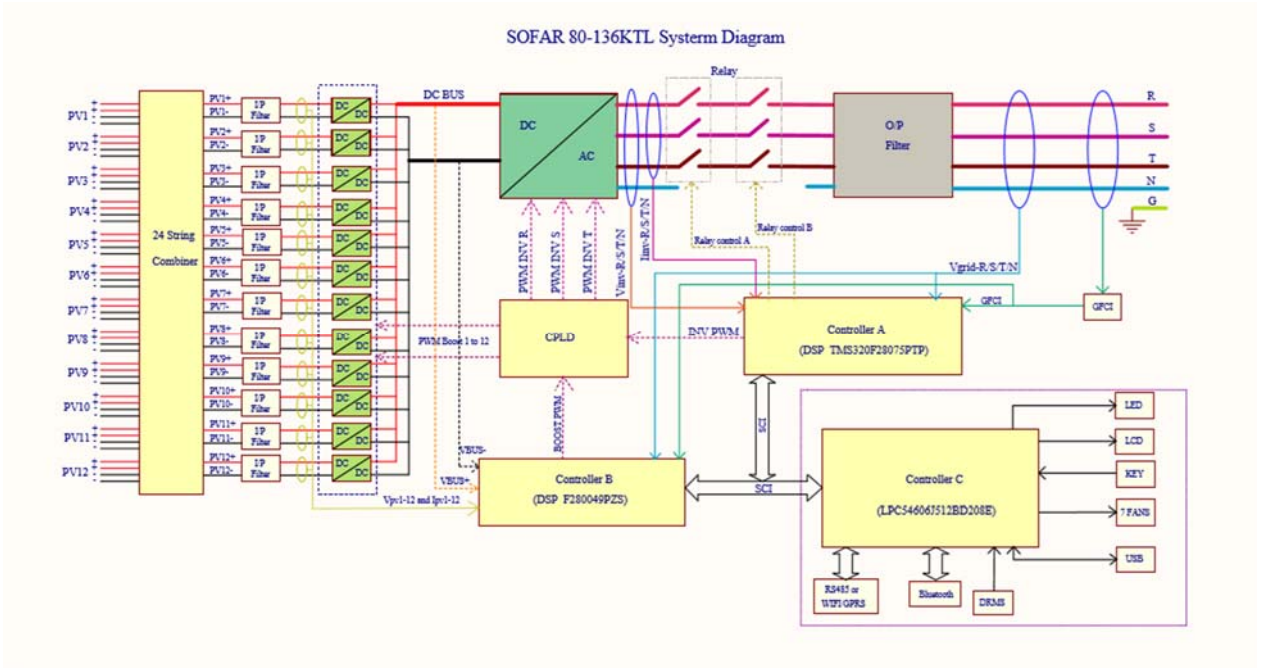
Front side of Lightning protection board

Back side of Lightning protection board


AC Connection interface

Side view


Serial Number

Software Version
      

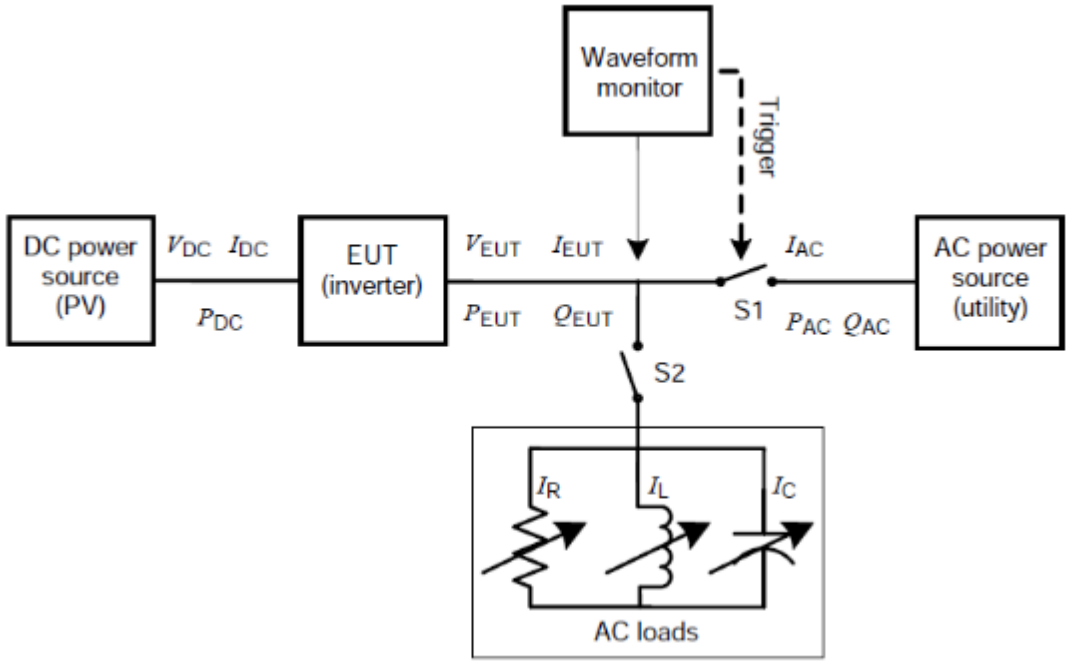
2 ELECTRICAL SCHEMES



Attachment II

(Testing information)

1 TESTING CIRCUIT



Current and voltage clamps have been connected to the inverter input/output for all the tests.

All the tests and checks have been performed in accordance with the reference standard under testing.

2 TESTING EQUIPMENT

From	No.	Equipment Name	MARK/Model No.	Equipment No.	Equipment calibration due date
BALUN	1	Digital oscilloscope	Tektronix / MS04054B	BZ-DGD-L064	2020-03-04 to 2021-03-03
	2	Current clamp	HIOKI / CT6863-05	BZ-DGD-L026-1	2020-03-04 to 2021-03-03
	3	Current clamp	HIOKI / CT6863-05	BZ-DGD-L026-2	2020-03-04 to 2021-03-03
	4	Current clamp	HIOKI / CT6863-05	BZ-DGD-L026-3	2020-03-04 to 2021-03-03
	5	Current clamp	HIOKI / CT6863-05	BZ-DGD-L026-4	2020-03-04 to 2021-03-03
	6	Power analyzer	HIOKI / PW6001-16	BZ-DGD-L025	2020-03-04 to 2021-03-03
	7	Power analyzer	DEWETRON / DEWE2-A4	BZ-DGD-L119	2020-03-04 to 2021-03-03
	8	Chamber	OK/OK-TS-6000	BZ-DGB-L028	2019-10-22 to 2020-10-21
	9	Temperature and Humidity meter	HIOKI /DT-322	BZ-DGD-L005	2020-03-07 to 2021-03-06
	10	Power analyzer	ZhiYuan / PA6000H	BZ-DGD-L059	2019-11-07 to 2020-11-06
SGS	11	True RMS Multimeter	Fluke / 187	GZE012-8	2019-12-05 to 2020-12-04

Items	Specifications
1) PV array simulator	
a) Voltage range	0 – 1000Vdc (0.01V step)
b) Current range	0 – 40A (0.01A step)
2) AC power source	
a) Output wiring	Three phase
b) Output capacity	30KVA
c) Output voltage	10-300Vrms
d) Output frequency	45-65Hz
e) Voltage stability	± 100ppm/℃
f) Output voltage distortion	0.05% max.
3) Digital meter	
a) Voltage range	0 – 1000Vdc, 0 – 600Vrms
b) Current range	0 – 30A
c) Frequency range (accuracy)	0.2%
d) Measurement items	Voltage (V) Current (A) Active power (W) Reactive power (Var) Volt-ampere (VA) Power factor (PF) Frequency (Hz) Electric energy (Wh)
4) Waveform recorder	
a) Sampling speed	1M/s
b) Recording device	Memory record and USB reading
c) Time accuracy	± 500ppm
5) AC load	
a) Resistive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KW
b) Inductive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KVA
c) Capacitive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 30KVA

3 MEASUREMENT UNCERTAINTY

Magnitude	Uncertainty
Voltage measurement	±1.5 %
Current measurement	±2.0 %
Frequency measurement	±0.2 %
Time measurement	±0.2 %
Power measurement	±2.5 %
Phase Angle	±1º
Temperature	±3º C
Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties. The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the petitioner. Note2: Where the standard requires lower uncertainties that those in this table. Most restrictive uncertainty has been considered.	

Attachment III

(GRAPHS AND SCREENSHORTS OF TEST RESULTS)

Flickers

The measurements of voltage fluctuations have been measured at 33 %, 66% and 100 % of the nominal power value of the inverter.

As it can be seen in the next screenshots, this test has two steps:

1. Starting operation
2. Stopping operation

The values took of Dmax of the two steps.

Starting operation and Stopping operation for 50Hz

33% Pn (Phase A)

33% Pn (Phase B)

33% Pn (Phase C)

66% Pn (Phase A)

66% Pn (Phase B)

66% Pn (Phase C)

100% Pn (Phase A)

100% Pn (Phase B)

100% Pn (Phase C)

Starting operation and Stopping operation for 60Hz

33% Pn (Phase A)

33% Pn (Phase B)

33% Pn (Phase C)

66% Pn (Phase A)

66% Pn (Phase B)

66% Pn (Phase C)

100% Pn (Phase A)

100% Pn (Phase B)

100% Pn (Phase C)

As it can be seen in the next screenshots is running operation. The values took of Pst and Plt are the most unfavorable of the twelve steps.

Running operation for 50Hz

33% Pn (Phase A)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	-0.004	Pass	0.386	Pass	0.0	Pass	0.217	Pass		
2	0.013	Pass	0.390	Pass	0.0	Pass	0.220	Pass		
3	-0.006	Pass	-0.364	Pass	0.0	Pass	0.210	Pass		
4	-0.013	Pass	0.367	Pass	0.0	Pass	0.222	Pass		
5	0.020	Pass	0.206	Pass	0.0	Pass	0.225	Pass		
6	0.010	Pass	0.330	Pass	0.0	Pass	0.218	Pass		
7	-0.008	Pass	0.388	Pass	0.0	Pass	0.215	Pass		
8	0.010	Pass	0.223	Pass	0.0	Pass	0.216	Pass		
9	0.016	Pass	0.162	Pass	0.0	Pass	0.216	Pass		
10	0.011	Pass	0.323	Pass	0.0	Pass	0.234	Pass		
11	0.001	Pass	0.210	Pass	0.0	Pass	0.225	Pass		
12	0.019	Pass	0.355	Pass	0.0	Pass	0.228	Pass		
Result		Pass		Pass		Pass		Pass	0.221	Pass

33% Pn (Phase B)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	-0.000	Pass	-0.503	Pass	0.0	Pass	0.224	Pass		
2	-0.012	Pass	0.540	Pass	0.0	Pass	0.227	Pass		
3	-0.004	Pass	0.523	Pass	0.0	Pass	0.232	Pass		
4	-0.004	Pass	-0.554	Pass	0.0	Pass	0.232	Pass		
5	-0.005	Pass	-0.544	Pass	0.0	Pass	0.219	Pass		
6	0.005	Pass	-0.568	Pass	0.0	Pass	0.227	Pass		
7	0.000	Pass	0.000	Pass	0.0	Pass	0.227	Pass		
8	0.016	Pass	-0.541	Pass	0.0	Pass	0.224	Pass		
9	-0.005	Pass	-0.530	Pass	0.0	Pass	0.230	Pass		
10	0.012	Pass	-0.505	Pass	0.0	Pass	0.228	Pass		
11	-0.009	Pass	-0.568	Pass	0.0	Pass	0.226	Pass		
12	-0.005	Pass	-0.538	Pass	0.0	Pass	0.233	Pass		
Result		Pass		Pass		Pass		Pass	0.227	Pass

33% Pn (Phase C)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.010	Pass	0.336	Pass	0.0	Pass	0.233	Pass		
2	0.013	Pass	0.380	Pass	0.0	Pass	0.227	Pass		
3	0.008	Pass	0.593	Pass	0.0	Pass	0.233	Pass		
4	0.003	Pass	0.440	Pass	0.0	Pass	0.224	Pass		
5	0.008	Pass	0.536	Pass	0.0	Pass	0.227	Pass		
6	0.006	Pass	0.419	Pass	0.0	Pass	0.221	Pass		
7	0.006	Pass	0.368	Pass	0.0	Pass	0.242	Pass		
8	0.006	Pass	0.488	Pass	0.0	Pass	0.226	Pass		
9	0.005	Pass	0.173	Pass	0.0	Pass	0.237	Pass		
10	0.006	Pass	0.490	Pass	0.0	Pass	0.232	Pass		
11	-0.008	Pass	-0.356	Pass	0.0	Pass	0.244	Pass		
12	0.022	Pass	0.489	Pass	0.0	Pass	0.243	Pass		
Result		Pass		Pass		Pass		Pass	0.233	Pass

66% Pn (Phase A)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.007	Pass	0.340	Pass	0.0	Pass	0.255	Pass		
2	-0.006	Pass	0.336	Pass	0.0	Pass	0.251	Pass		
3	-0.006	Pass	0.366	Pass	0.0	Pass	0.252	Pass		
4	-0.006	Pass	0.352	Pass	0.0	Pass	0.249	Pass		
5	0.006	Pass	0.408	Pass	0.0	Pass	0.245	Pass		
6	0.005	Pass	0.394	Pass	0.0	Pass	0.248	Pass		
7	-0.005	Pass	0.384	Pass	0.0	Pass	0.240	Pass		
8	0.005	Pass	0.423	Pass	0.0	Pass	0.246	Pass		
9	-0.005	Pass	0.378	Pass	0.0	Pass	0.244	Pass		
10	-0.006	Pass	0.367	Pass	0.0	Pass	0.244	Pass		
11	-0.008	Pass	0.344	Pass	0.0	Pass	0.241	Pass		
12	-0.009	Pass	0.365	Pass	0.0	Pass	0.239	Pass		
Result		Pass		Pass		Pass		Pass	0.246	Pass

66% Pn (Phase B)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.005	Pass	0.364	Pass	0.0	Pass	0.258	Pass		
2	0.006	Pass	0.364	Pass	0.0	Pass	0.255	Pass		
3	0.007	Pass	0.369	Pass	0.0	Pass	0.252	Pass		
4	-0.007	Pass	0.403	Pass	0.0	Pass	0.251	Pass		
5	0.005	Pass	0.394	Pass	0.0	Pass	0.247	Pass		
6	-0.004	Pass	0.368	Pass	0.0	Pass	0.244	Pass		
7	-0.005	Pass	0.399	Pass	0.0	Pass	0.241	Pass		
8	-0.005	Pass	0.402	Pass	0.0	Pass	0.246	Pass		
9	0.007	Pass	0.406	Pass	0.0	Pass	0.244	Pass		
10	-0.004	Pass	0.427	Pass	0.0	Pass	0.243	Pass		
11	-0.004	Pass	0.433	Pass	0.0	Pass	0.242	Pass		
12	0.004	Pass	0.382	Pass	0.0	Pass	0.240	Pass		
Result		Pass		Pass		Pass		Pass	0.247	Pass

66% Pn (Phase C)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	-0.012	Pass	0.511	Pass	0.0	Pass	0.253	Pass		
2	-0.009	Pass	-0.505	Pass	0.0	Pass	0.223	Pass		
3	-0.004	Pass	-0.508	Pass	0.0	Pass	0.219	Pass		
4	0.015	Pass	-0.520	Pass	0.0	Pass	0.222	Pass		
5	-0.013	Pass	0.590	Pass	0.0	Pass	0.226	Pass		
6	-0.008	Pass	-0.524	Pass	0.0	Pass	0.225	Pass		
7	0.003	Pass	-0.524	Pass	0.0	Pass	0.226	Pass		
8	0.000	Pass	0.000	Pass	0.0	Pass	0.232	Pass		
9	-0.026	Pass	0.565	Pass	0.0	Pass	0.221	Pass		
10	-0.012	Pass	-0.558	Pass	0.0	Pass	0.231	Pass		
11	-0.015	Pass	-0.503	Pass	0.0	Pass	0.235	Pass		
12	-0.008	Pass	0.550	Pass	0.0	Pass	0.248	Pass		
Result		Pass		Pass		Pass		Pass	0.230	Pass

100% Pn (Phase A)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.148	Pass	0.330	Pass	0.0	Pass	0.323	Pass		
2	0.211	Pass	0.306	Pass	0.0	Pass	0.322	Pass		
3	0.188	Pass	0.303	Pass	0.0	Pass	0.295	Pass		
4	-0.204	Pass	-0.306	Pass	0.0	Pass	0.309	Pass		
5	0.144	Pass	0.314	Pass	0.0	Pass	0.299	Pass		
6	-0.208	Pass	-0.287	Pass	0.0	Pass	0.301	Pass		
7	0.096	Pass	0.336	Pass	0.0	Pass	0.275	Pass		
8	-0.212	Pass	-0.286	Pass	0.0	Pass	0.289	Pass		
9	0.186	Pass	0.348	Pass	0.0	Pass	0.285	Pass		
10	0.168	Pass	0.331	Pass	0.0	Pass	0.282	Pass		
11	0.118	Pass	0.346	Pass	0.0	Pass	0.278	Pass		
12	0.188	Pass	-0.327	Pass	0.0	Pass	0.283	Pass		
Result		Pass		Pass		Pass		Pass	0.296	Pass

100% Pn (Phase B)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	-0.008	Pass	-0.534	Pass	0.0	Pass	0.357	Pass		
2	0.010	Pass	0.539	Pass	0.0	Pass	0.343	Pass		
3	-0.013	Pass	-0.601	Pass	0.0	Pass	0.344	Pass		
4	-0.010	Pass	0.560	Pass	0.0	Pass	0.323	Pass		
5	0.008	Pass	0.548	Pass	0.0	Pass	0.320	Pass		
6	-0.014	Pass	0.585	Pass	0.0	Pass	0.324	Pass		
7	-0.009	Pass	-0.570	Pass	0.0	Pass	0.297	Pass		
8	0.015	Pass	-0.562	Pass	0.0	Pass	0.291	Pass		
9	0.007	Pass	-0.611	Pass	0.0	Pass	0.307	Pass		
10	-0.023	Pass	0.570	Pass	0.0	Pass	0.314	Pass		
11	0.004	Pass	-0.567	Pass	0.0	Pass	0.306	Pass		
12	-0.011	Pass	-0.545	Pass	0.0	Pass	0.310	Pass		
Result		Pass		Pass		Pass		Pass	0.320	Pass

100% Pn (Phase C)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.015	Pass	0.534	Pass	0.0	Pass	0.385	Pass		
2	-0.028	Pass	-0.537	Pass	0.0	Pass	0.370	Pass		
3	0.016	Pass	0.584	Pass	0.0	Pass	0.348	Pass		
4	0.019	Pass	0.513	Pass	0.0	Pass	0.347	Pass		
5	0.012	Pass	0.580	Pass	0.0	Pass	0.347	Pass		
6	0.006	Pass	0.503	Pass	0.0	Pass	0.337	Pass		
7	-0.012	Pass	-0.531	Pass	0.0	Pass	0.323	Pass		
8	0.013	Pass	-0.572	Pass	0.0	Pass	0.320	Pass		
9	0.006	Pass	0.516	Pass	0.0	Pass	0.317	Pass		
10	0.029	Pass	-0.507	Pass	0.0	Pass	0.321	Pass		
11	-0.025	Pass	-0.558	Pass	0.0	Pass	0.316	Pass		
12	-0.010	Pass	0.603	Pass	0.0	Pass	0.324	Pass		
Result		Pass		Pass		Pass		Pass	0.339	Pass

Running operation for 60Hz

33% Pn (Phase A)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.007 Pass	0.297 Pass	0.0 Pass	0.275 Pass	
2	0.002 Pass	0.302 Pass	0.0 Pass	0.275 Pass	
3	-0.005 Pass	0.285 Pass	0.0 Pass	0.276 Pass	
4	-0.004 Pass	0.300 Pass	0.0 Pass	0.275 Pass	
5	0.006 Pass	0.265 Pass	0.0 Pass	0.274 Pass	
6	0.004 Pass	0.310 Pass	0.0 Pass	0.274 Pass	
7	0.002 Pass	0.268 Pass	0.0 Pass	0.273 Pass	
8	-0.005 Pass	0.293 Pass	0.0 Pass	0.275 Pass	
9	-0.005 Pass	0.254 Pass	0.0 Pass	0.274 Pass	
10	-0.004 Pass	0.298 Pass	0.0 Pass	0.275 Pass	
11	-0.007 Pass	0.262 Pass	0.0 Pass	0.273 Pass	
12	0.003 Pass	0.301 Pass	0.0 Pass	0.275 Pass	
Result	Pass	Pass	Pass	Pass	0.274 Pass

33% Pn (Phase B)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.182 Pass	0.659 Pass	0.0 Pass	0.275 Pass	
2	-0.127 Pass	0.383 Pass	0.0 Pass	0.278 Pass	
3	0.124 Pass	0.361 Pass	0.0 Pass	0.276 Pass	
4	-0.147 Pass	0.353 Pass	0.0 Pass	0.278 Pass	
5	0.153 Pass	0.436 Pass	0.0 Pass	0.277 Pass	
6	0.175 Pass	0.378 Pass	0.0 Pass	0.278 Pass	
7	0.130 Pass	0.368 Pass	0.0 Pass	0.277 Pass	
8	-0.131 Pass	0.356 Pass	0.0 Pass	0.278 Pass	
9	0.174 Pass	0.704 Pass	0.0 Pass	0.278 Pass	
10	-0.140 Pass	0.367 Pass	0.0 Pass	0.277 Pass	
11	0.152 Pass	0.427 Pass	0.0 Pass	0.276 Pass	
12	0.181 Pass	0.657 Pass	0.0 Pass	0.277 Pass	
Result	Pass	Pass	Pass	Pass	0.277 Pass

33% Pn (Phase C)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.004 Pass	0.275 Pass	0.0 Pass	0.281 Pass	
2	0.000 Pass	0.000 Pass	0.0 Pass	0.281 Pass	
3	0.004 Pass	0.268 Pass	0.0 Pass	0.281 Pass	
4	-0.004 Pass	0.250 Pass	0.0 Pass	0.280 Pass	
5	-0.006 Pass	0.277 Pass	0.0 Pass	0.281 Pass	
6	-0.005 Pass	0.253 Pass	0.0 Pass	0.280 Pass	
7	0.005 Pass	0.268 Pass	0.0 Pass	0.280 Pass	
8	0.002 Pass	0.265 Pass	0.0 Pass	0.281 Pass	
9	-0.004 Pass	0.277 Pass	0.0 Pass	0.282 Pass	
10	0.001 Pass	0.251 Pass	0.0 Pass	0.280 Pass	
11	0.002 Pass	0.272 Pass	0.0 Pass	0.280 Pass	
12	-0.006 Pass	0.267 Pass	0.0 Pass	0.280 Pass	
Result	Pass	Pass	Pass	Pass	0.281 Pass

66% Pn (Phase A)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.000 Pass	0.000 Pass	0.0 Pass	0.245 Pass	
2	0.211 Pass	0.306 Pass	0.0 Pass	0.269 Pass	
3	0.188 Pass	0.303 Pass	0.0 Pass	0.286 Pass	
4	-0.204 Pass	-0.306 Pass	0.0 Pass	0.276 Pass	
5	0.144 Pass	0.314 Pass	0.0 Pass	0.267 Pass	
6	-0.208 Pass	-0.287 Pass	0.0 Pass	0.248 Pass	
7	0.096 Pass	0.336 Pass	0.0 Pass	0.290 Pass	
8	-0.212 Pass	-0.286 Pass	0.0 Pass	0.281 Pass	
9	0.000 Pass	0.000 Pass	0.0 Pass	0.292 Pass	
10	0.168 Pass	0.331 Pass	0.0 Pass	0.211 Pass	
11	0.000 Pass	0.000 Pass	0.0 Pass	0.256 Pass	
12	0.188 Pass	-0.327 Pass	0.0 Pass	0.260 Pass	
Result	Pass	Pass	Pass	Pass	0.278 Pass

66% Pn (Phase B)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	-0.169	Pass	0.287	Pass	0.0	Pass	0.253	Pass		
2	-0.137	Pass	-0.317	Pass	0.0	Pass	0.276	Pass		
3	-0.171	Pass	0.312	Pass	0.0	Pass	0.288	Pass		
4	-0.155	Pass	-0.321	Pass	0.0	Pass	0.272	Pass		
5	-0.172	Pass	-0.323	Pass	0.0	Pass	0.260	Pass		
6	0.000	Pass	0.000	Pass	0.0	Pass	0.254	Pass		
7	0.096	Pass	-0.346	Pass	0.0	Pass	0.200	Pass		
8	0.159	Pass	-0.299	Pass	0.0	Pass	0.290	Pass		
9	0.133	Pass	-0.317	Pass	0.0	Pass	0.289	Pass		
10	0.109	Pass	0.360	Pass	0.0	Pass	0.212	Pass		
11	0.197	Pass	0.309	Pass	0.0	Pass	0.253	Pass		
12	-0.147	Pass	0.301	Pass	0.0	Pass	0.260	Pass		
Result		Pass		Pass		Pass		Pass	0.280	Pass

66% Pn (Phase C)

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.203	Pass	0.491	Pass	0.0	Pass	0.252	Pass		
2	0.000	Pass	0.000	Pass	0.0	Pass	0.256	Pass		
3	-0.127	Pass	-0.511	Pass	0.0	Pass	0.273	Pass		
4	0.000	Pass	0.000	Pass	0.0	Pass	0.273	Pass		
5	0.053	Pass	0.511	Pass	0.0	Pass	0.277	Pass		
6	0.104	Pass	0.408	Pass	0.0	Pass	0.259	Pass		
7	-0.193	Pass	-0.549	Pass	0.0	Pass	0.270	Pass		
8	0.099	Pass	-0.408	Pass	0.0	Pass	0.268	Pass		
9	0.000	Pass	0.000	Pass	0.0	Pass	0.281	Pass		
10	-0.187	Pass	-0.543	Pass	0.0	Pass	0.203	Pass		
11	0.085	Pass	-0.372	Pass	0.0	Pass	0.263	Pass		
12	-0.036	Pass	-0.573	Pass	0.0	Pass	0.265	Pass		
Result		Pass		Pass		Pass		Pass	0.272	Pass

100% Pn (Phase A)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	0.056 Pass	0.507 Pass	0.0 Pass	0.267 Pass	
2	-0.020 Pass	0.534 Pass	0.0 Pass	0.269 Pass	
3	-0.017 Pass	-0.535 Pass	0.0 Pass	0.262 Pass	
4	-0.038 Pass	-0.589 Pass	0.0 Pass	0.272 Pass	
5	0.055 Pass	-0.606 Pass	0.0 Pass	0.286 Pass	
6	0.040 Pass	0.502 Pass	0.0 Pass	0.294 Pass	
7	-0.069 Pass	0.545 Pass	0.0 Pass	0.297 Pass	
8	0.079 Pass	0.591 Pass	0.0 Pass	0.290 Pass	
9	0.075 Pass	0.543 Pass	0.0 Pass	0.288 Pass	
10	0.092 Pass	0.583 Pass	0.0 Pass	0.270 Pass	
11	0.065 Pass	0.540 Pass	0.0 Pass	0.276 Pass	
12	-0.083 Pass	0.666 Pass	0.0 Pass	0.274 Pass	
Result	Pass	Pass	Pass	Pass	0.279 Pass

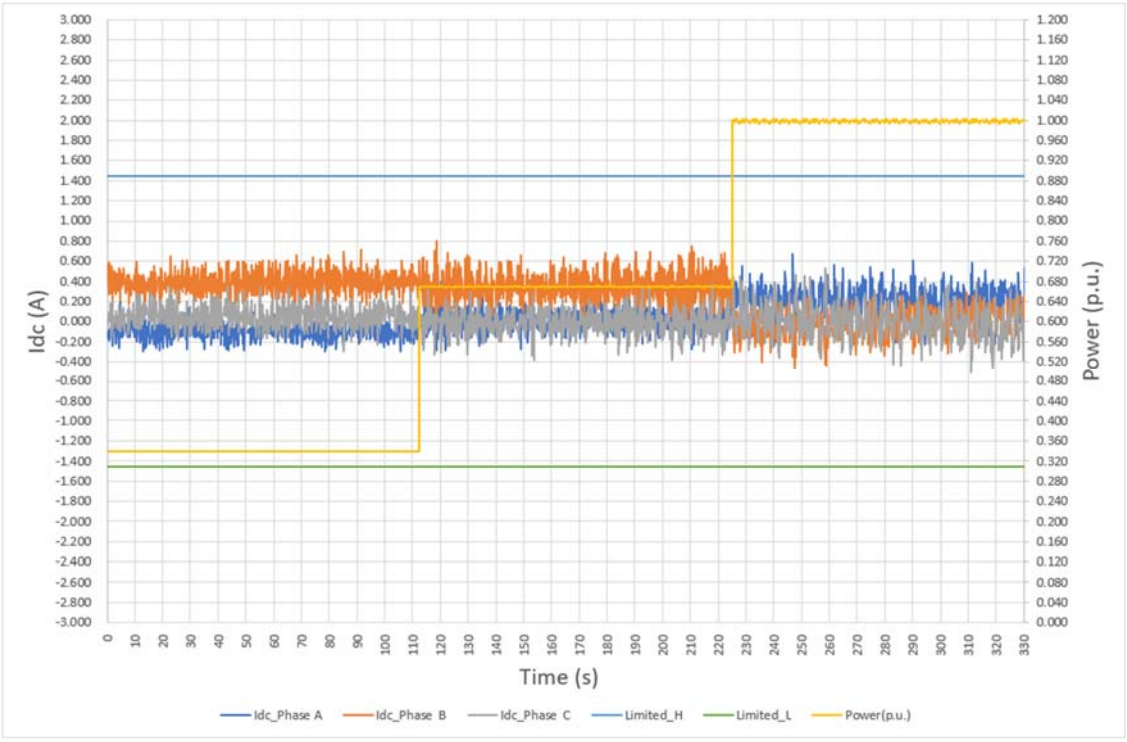
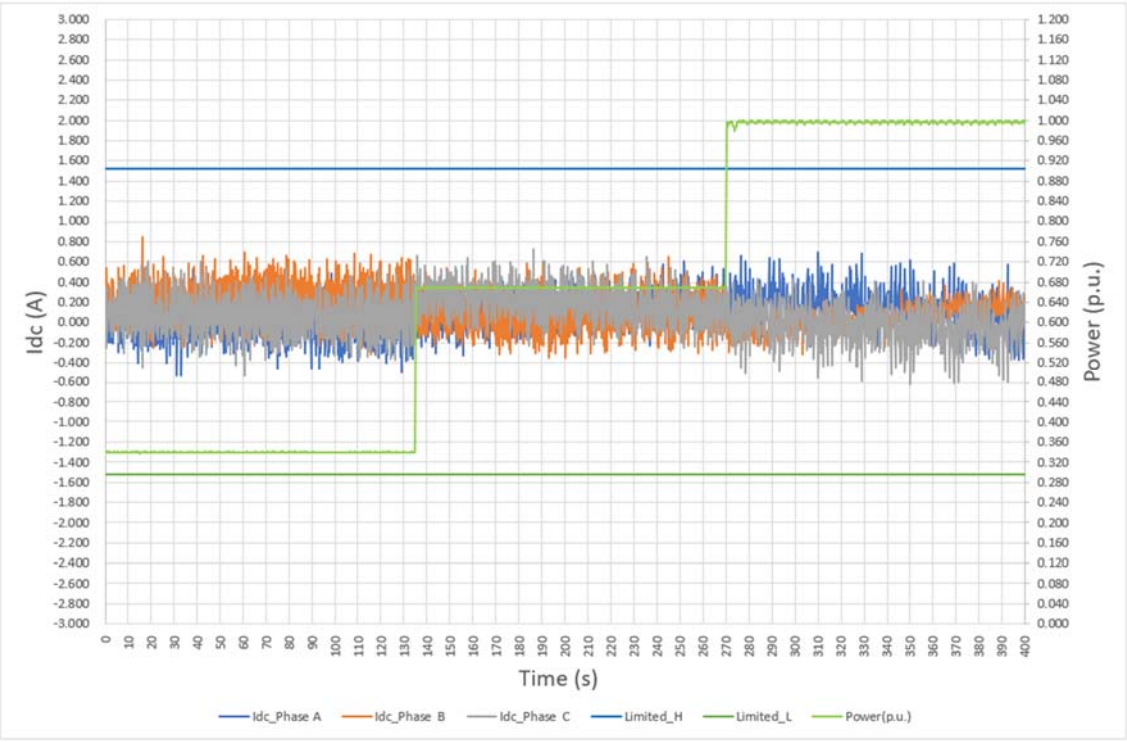
100% Pn (Phase B)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	-0.061 Pass	-0.508 Pass	0.0 Pass	0.255 Pass	
2	0.063 Pass	0.503 Pass	0.0 Pass	0.262 Pass	
3	0.055 Pass	0.516 Pass	0.0 Pass	0.245 Pass	
4	0.066 Pass	0.522 Pass	0.0 Pass	0.269 Pass	
5	-0.055 Pass	-0.509 Pass	0.0 Pass	0.267 Pass	
6	-0.066 Pass	-0.566 Pass	0.0 Pass	0.304 Pass	
7	-0.052 Pass	-0.552 Pass	0.0 Pass	0.283 Pass	
8	0.062 Pass	0.563 Pass	0.0 Pass	0.274 Pass	
9	0.054 Pass	0.516 Pass	0.0 Pass	0.277 Pass	
10	0.061 Pass	0.536 Pass	0.0 Pass	0.271 Pass	
11	0.079 Pass	0.560 Pass	0.0 Pass	0.287 Pass	
12	-0.086 Pass	-0.502 Pass	0.0 Pass	0.274 Pass	
Result	Pass	Pass	Pass	Pass	0.273 Pass

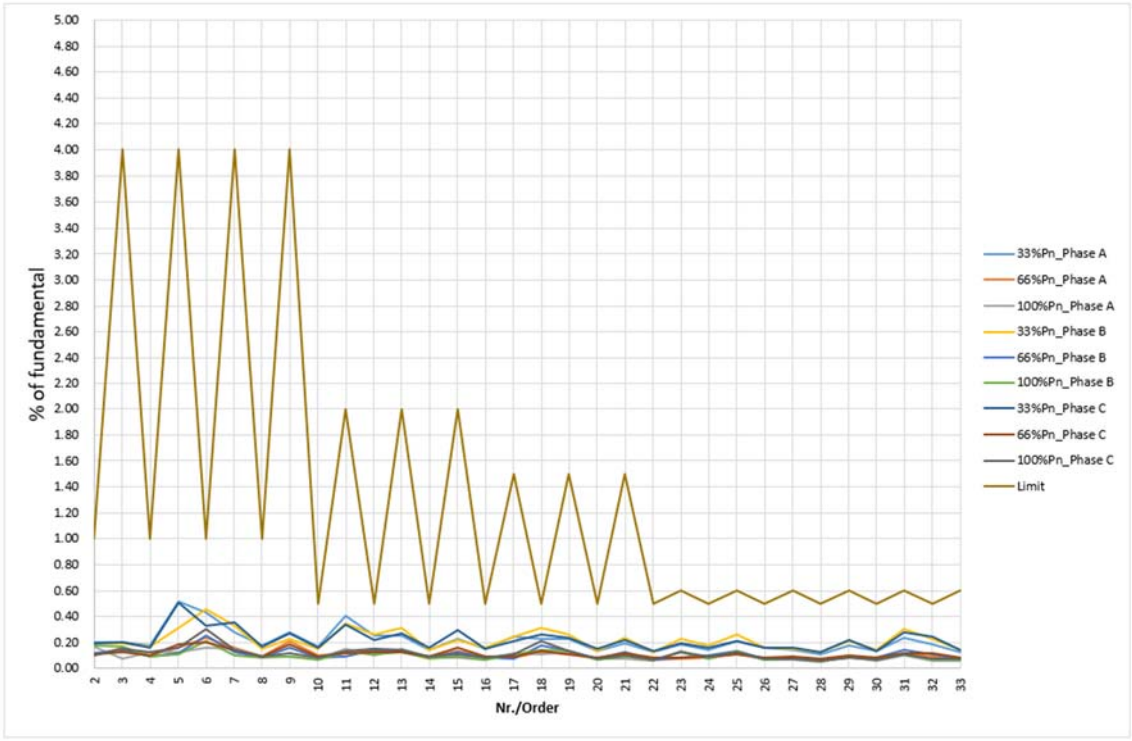
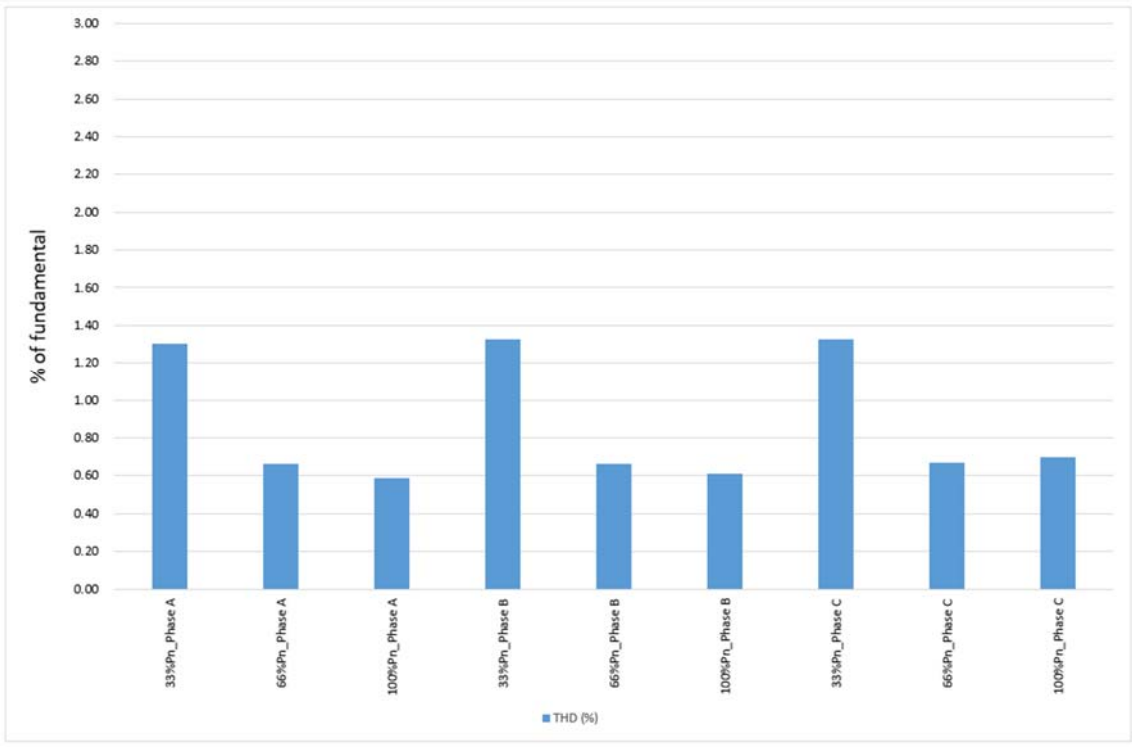
100% Pn (Phase C)

	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30%	1.00	0.65 N:12
No. 1	-0.025 Pass	-0.632 Pass	0.0 Pass	0.279 Pass	
2	0.021 Pass	0.740 Pass	0.0 Pass	0.262 Pass	
3	-0.042 Pass	0.672 Pass	0.0 Pass	0.277 Pass	
4	-0.053 Pass	0.634 Pass	0.0 Pass	0.254 Pass	
5	-0.069 Pass	0.783 Pass	0.0 Pass	0.281 Pass	
6	0.074 Pass	-0.644 Pass	0.0 Pass	0.284 Pass	
7	0.044 Pass	0.627 Pass	0.0 Pass	0.294 Pass	
8	-0.078 Pass	-0.777 Pass	0.0 Pass	0.280 Pass	
9	-0.090 Pass	0.642 Pass	0.0 Pass	0.281 Pass	
10	-0.094 Pass	0.777 Pass	0.0 Pass	0.277 Pass	
11	-0.075 Pass	-0.640 Pass	0.0 Pass	0.275 Pass	
12	-0.065 Pass	-0.628 Pass	0.0 Pass	0.292 Pass	
Result	Pass	Pass	Pass	Pass	0.278 Pass

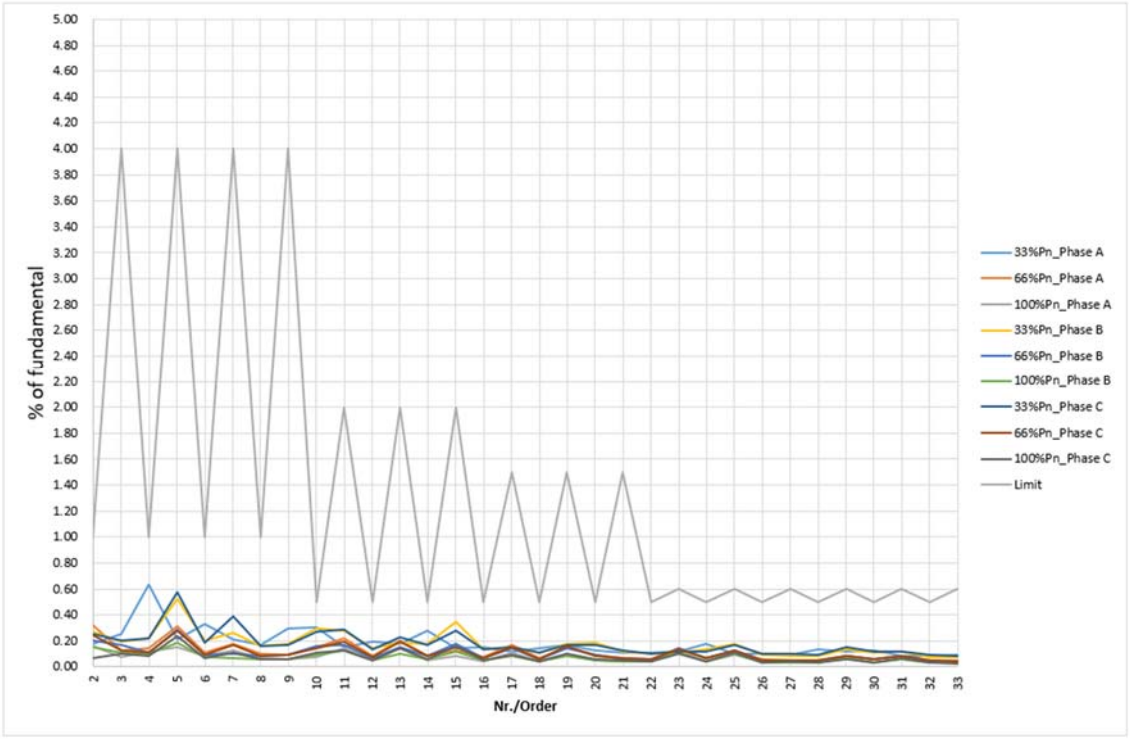
Direct current injection

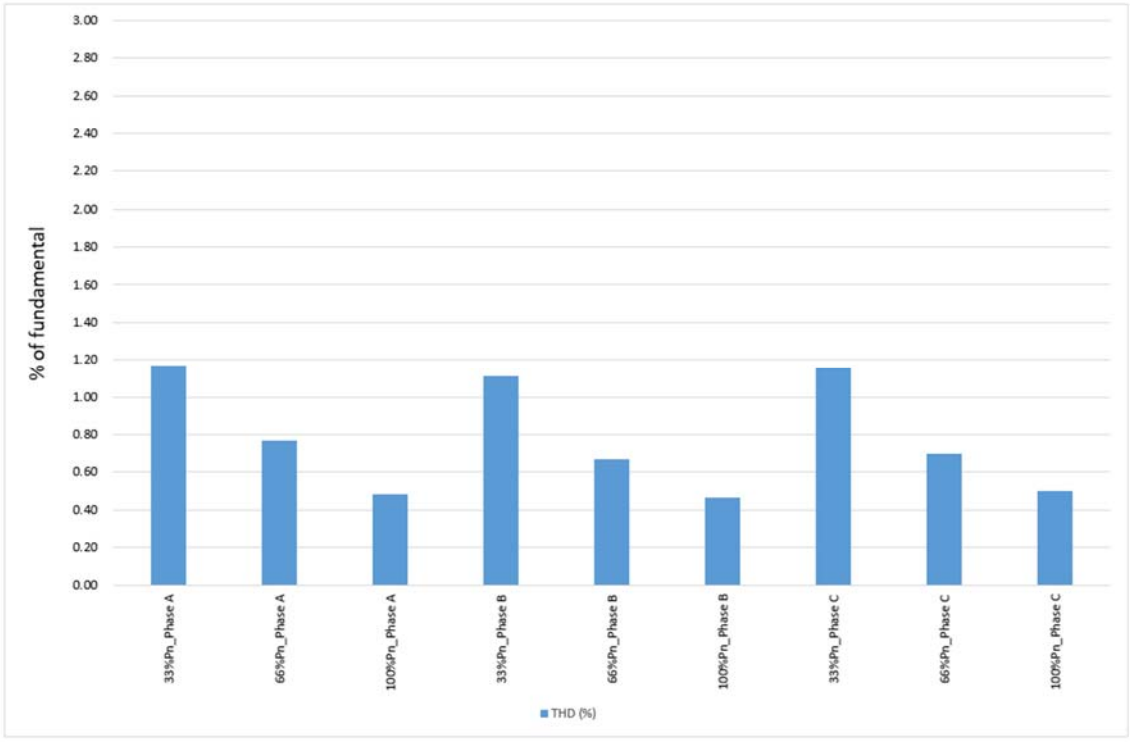
DCI of 50Hz

DCI of 60Hz


Harmonics and waveform distortion

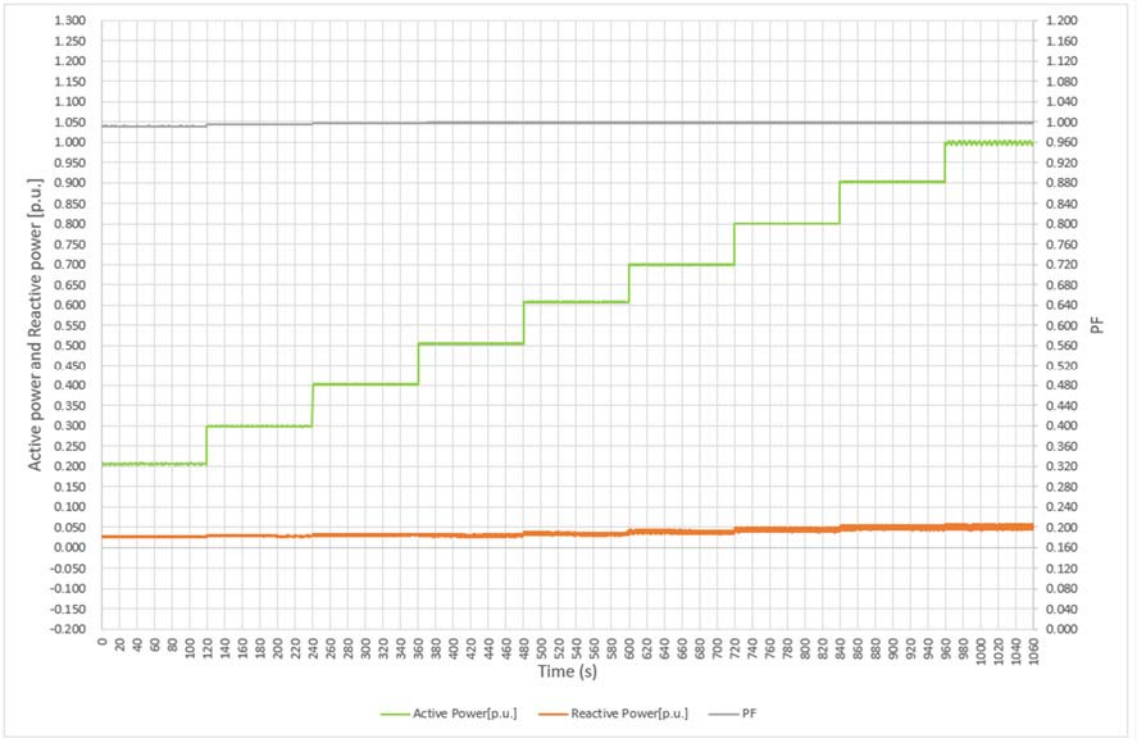
50Hz



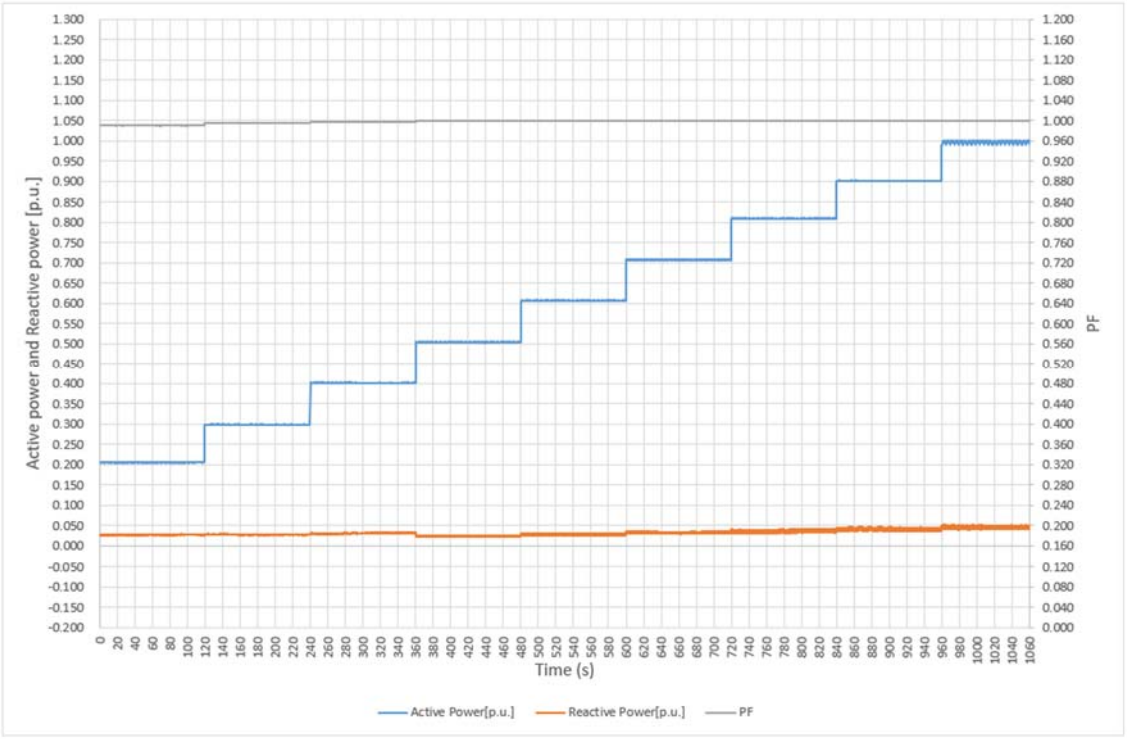
60Hz


% of fundamental
Nr./Order
33%Pn_Phase A
66%Pn_Phase A
100%Pn_Phase A
33%Pn_Phase B
66%Pn_Phase B
100%Pn_Phase B
33%Pn_Phase C
66%Pn_Phase C
100%Pn_Phase C
Limit

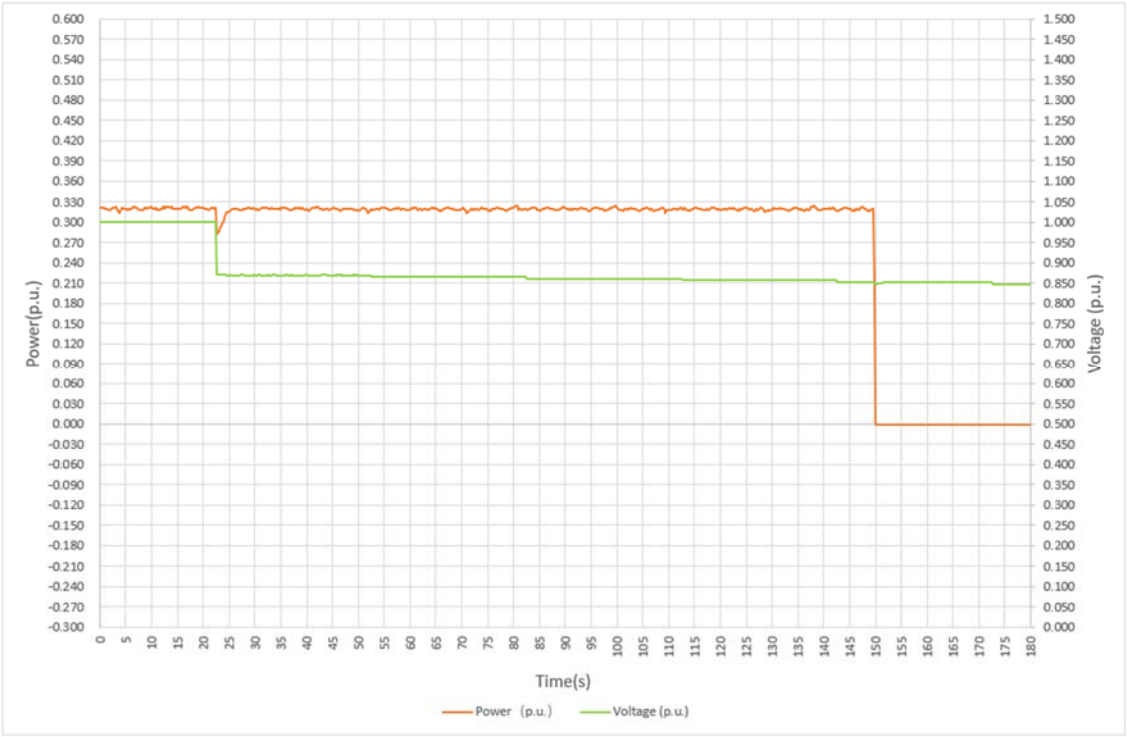
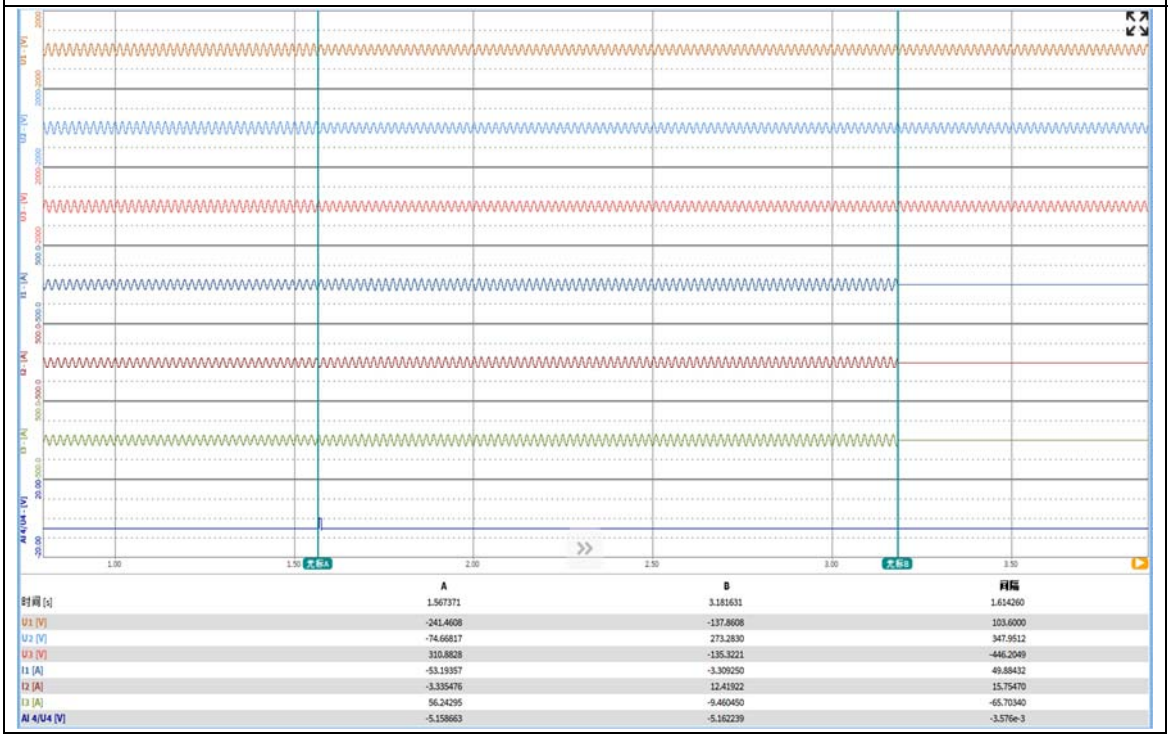

% of fundamental
33%Pn_Phase A
66%Pn_Phase A
100%Pn_Phase A
33%Pn_Phase B
66%Pn_Phase B
100%Pn_Phase B
33%Pn_Phase C
66%Pn_Phase C
100%Pn_Phase C
THD (%)

Power factor

50Hz


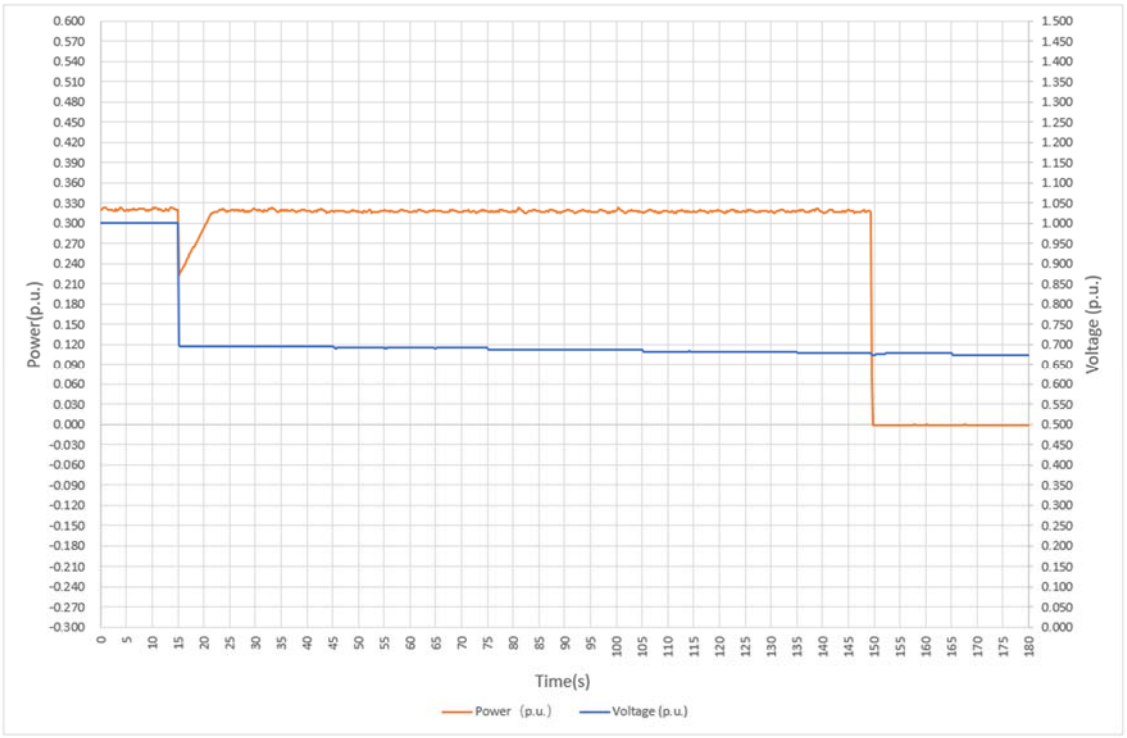
60Hz


Under-and over-voltage trip settings and reconnection test

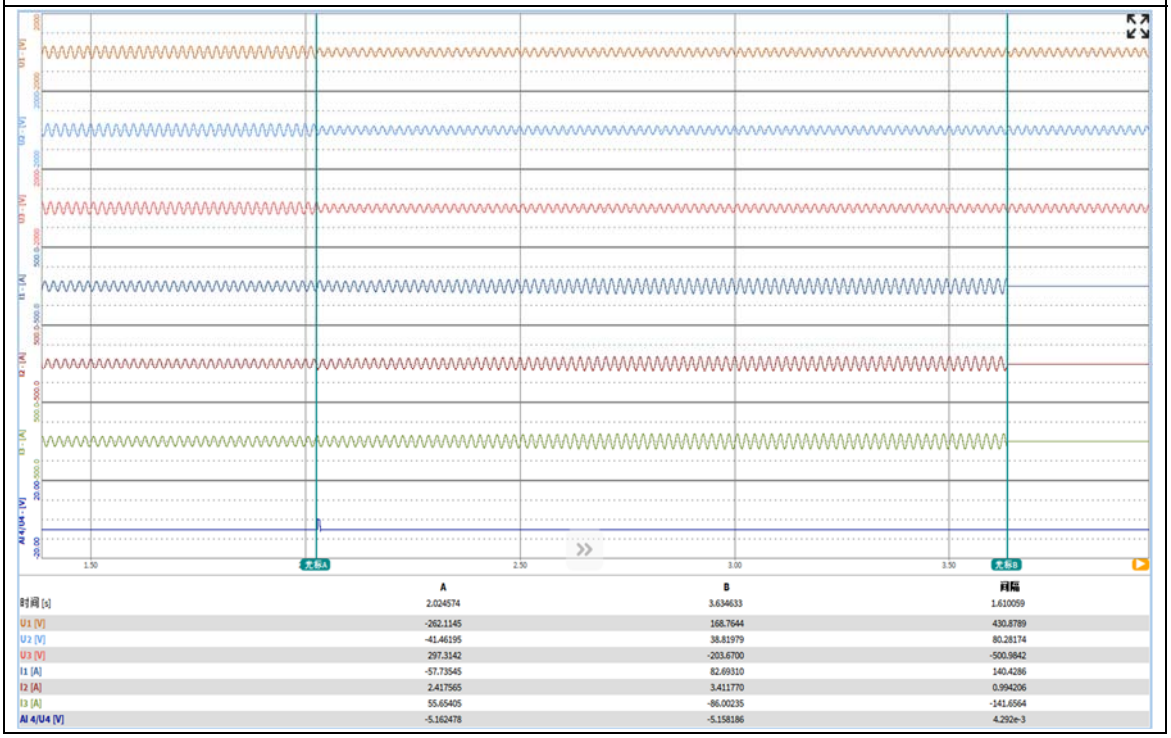
50 %Vn ≤ V < 85 %Vn (setting at 195V) of 230V
Trip Value

Disconnection Time


50 % ≤ V < 85 %(setting at 155V) of 230V

Trip Value

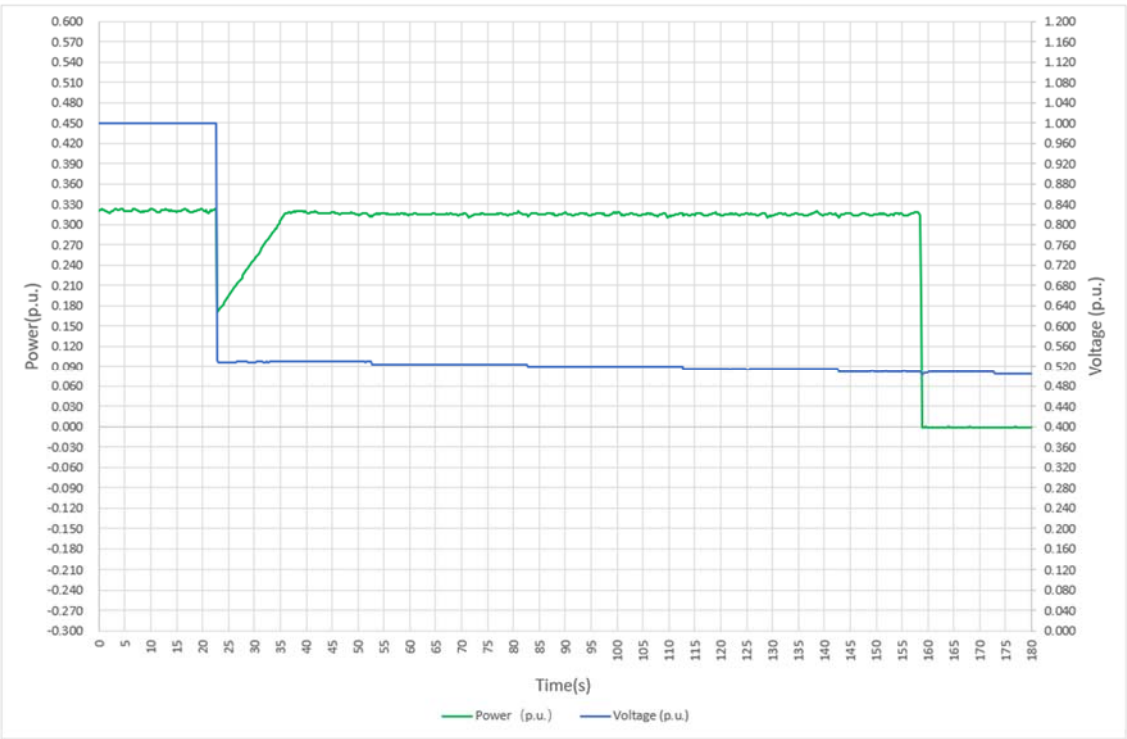


Disconnection Time

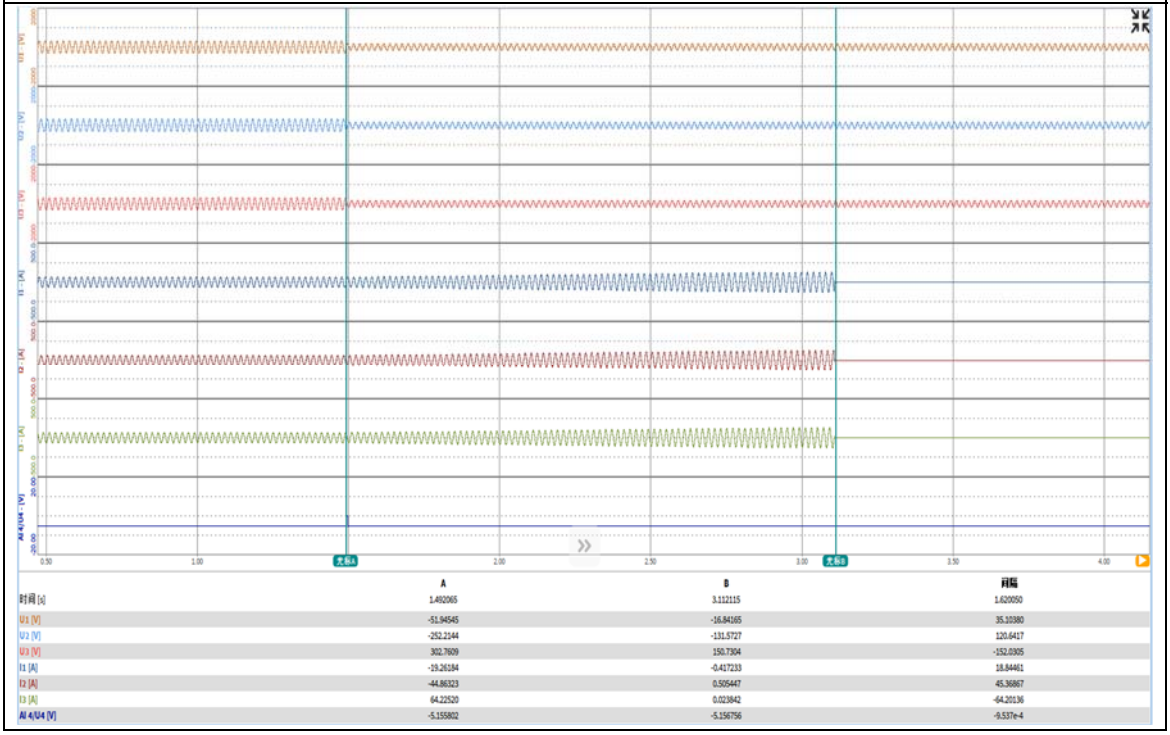


50 %Vn ≤ V < 85 %Vn (setting at 117V) of 230V

Trip Value

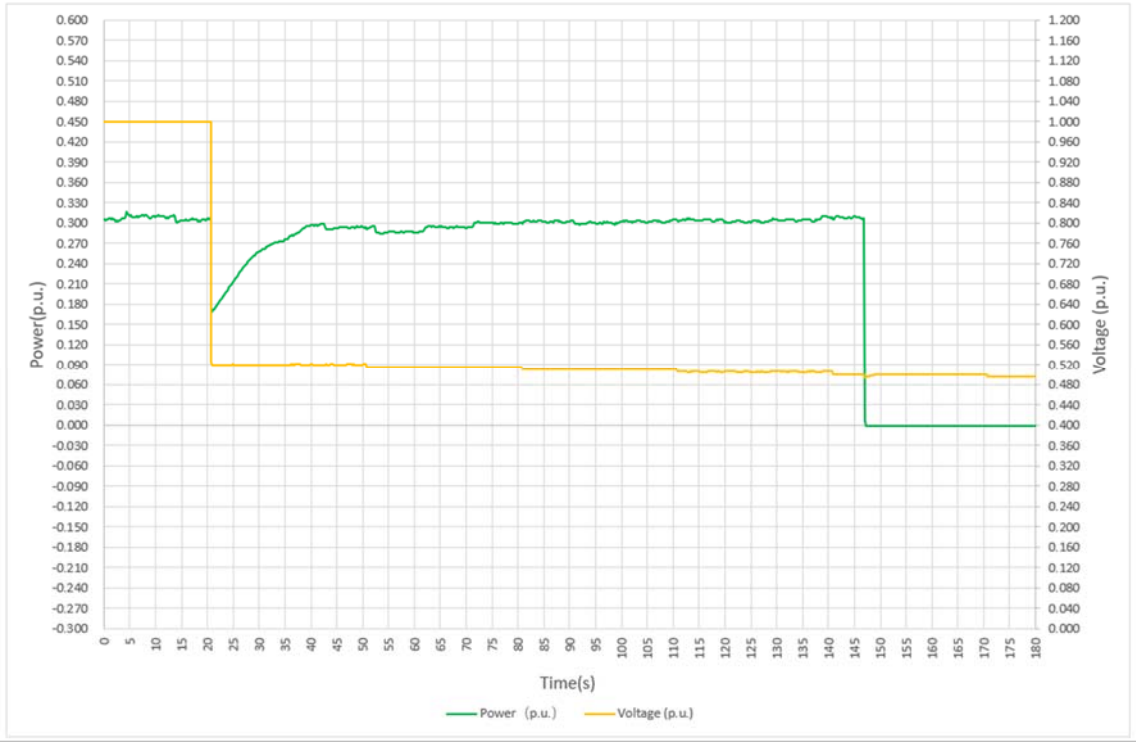


Disconnection Time

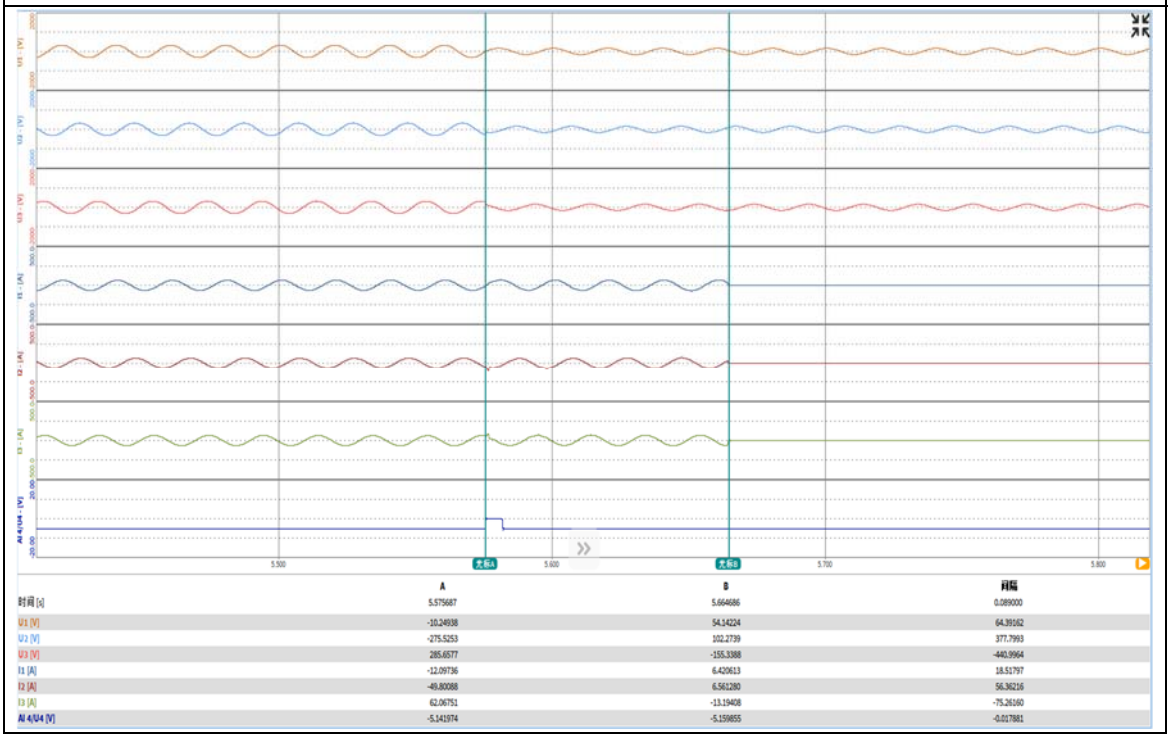


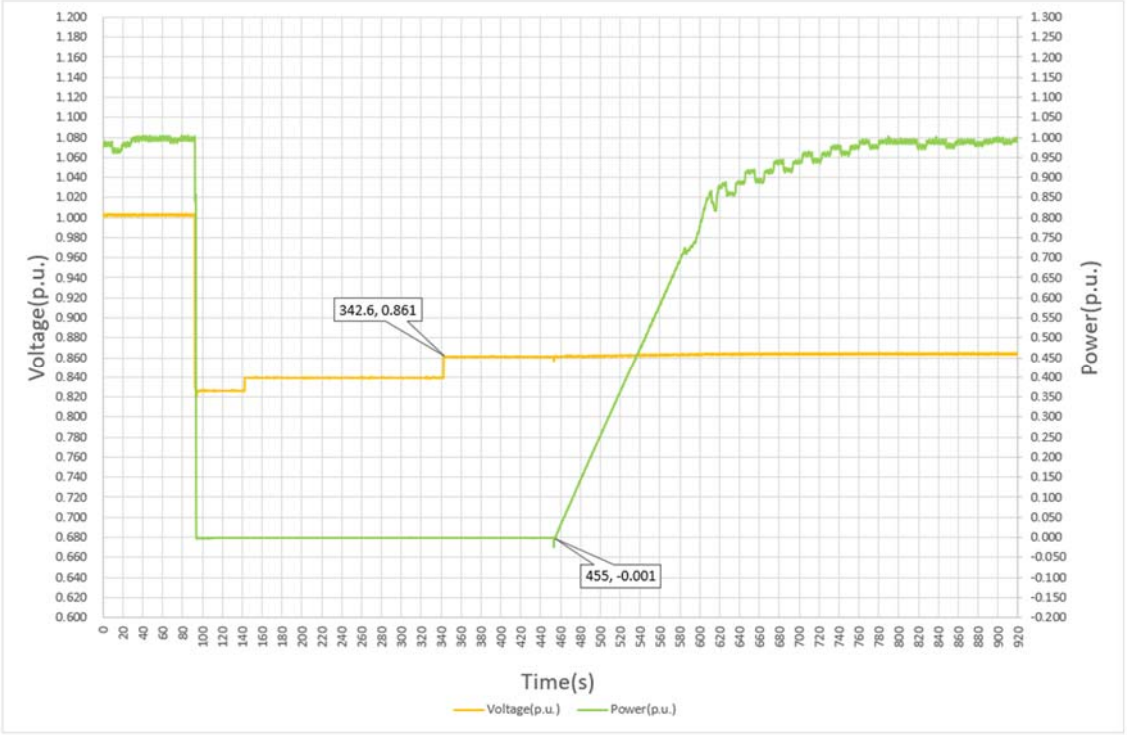
V < 50%Vn (setting at 114V) of 230V

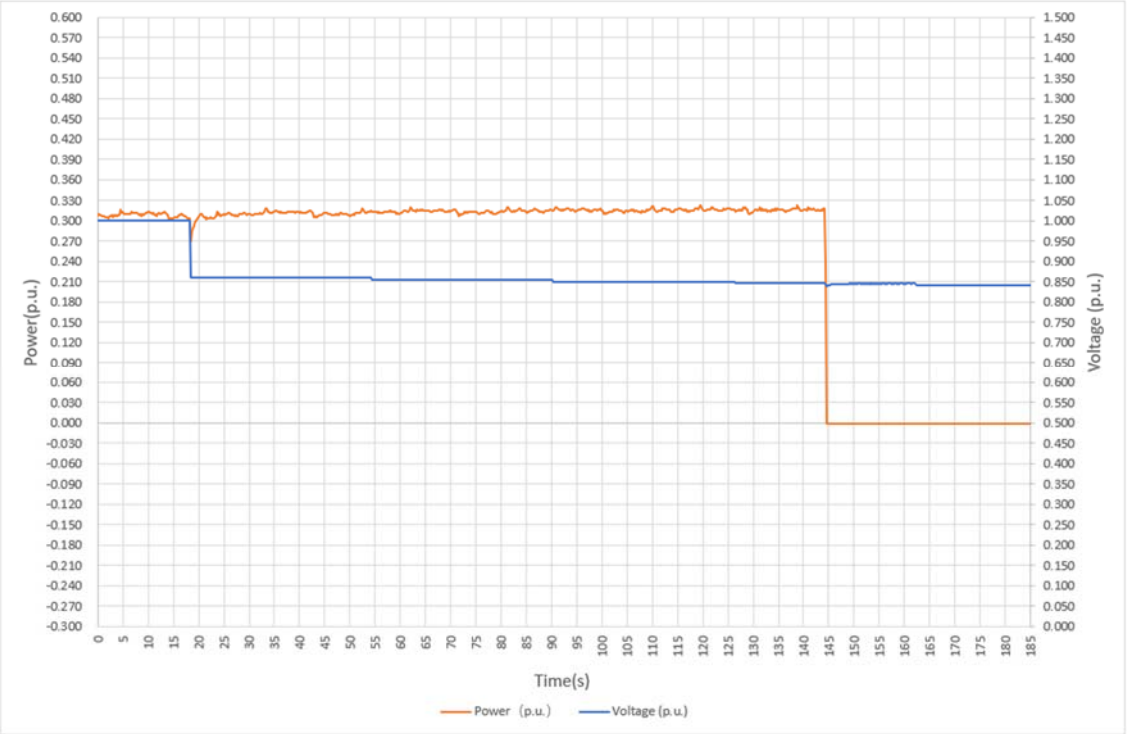
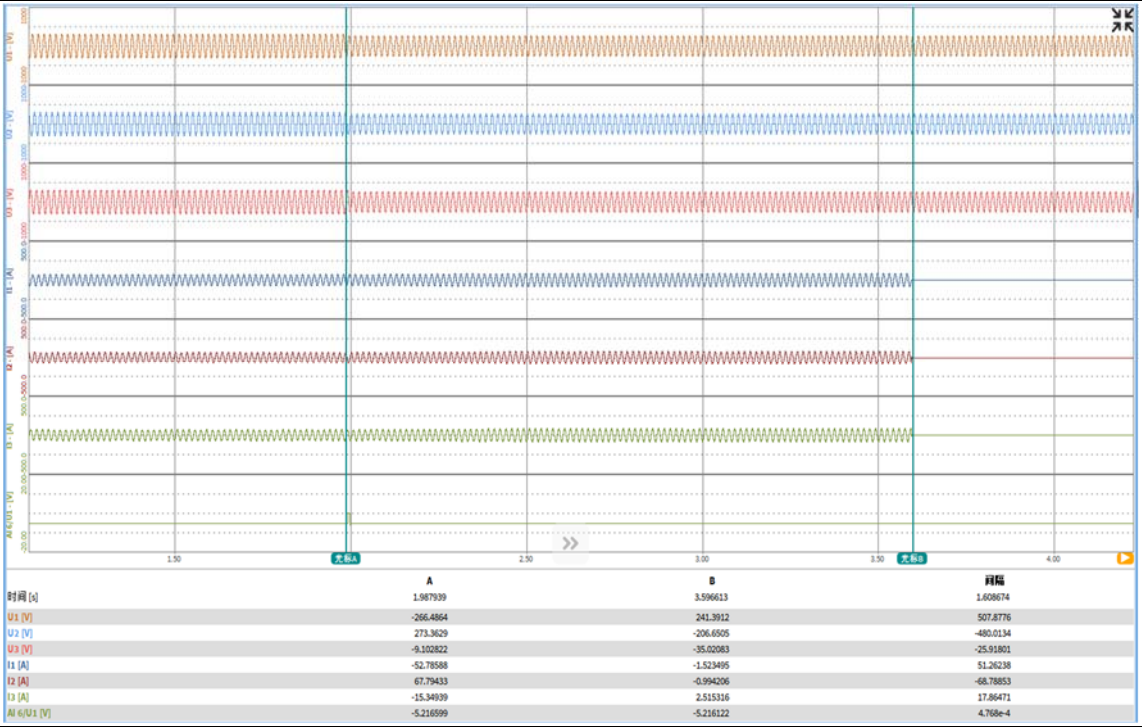
Trip Value



Disconnection Time

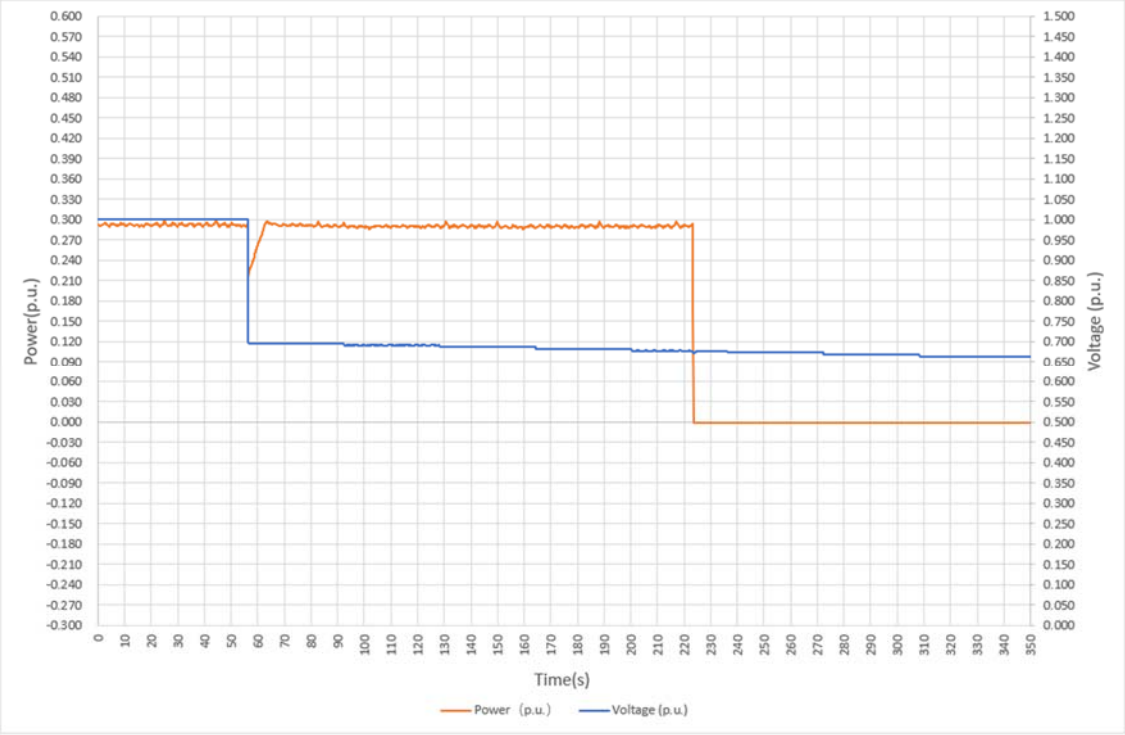


Under voltage Reconnection of 230V


50 %Vn ≤ V < 85 %Vn (setting at 186V) of 220V
Trip Value

Disconnection Time


50 % ≤ V < 85 %(setting at 149V) of 220V

Trip Value

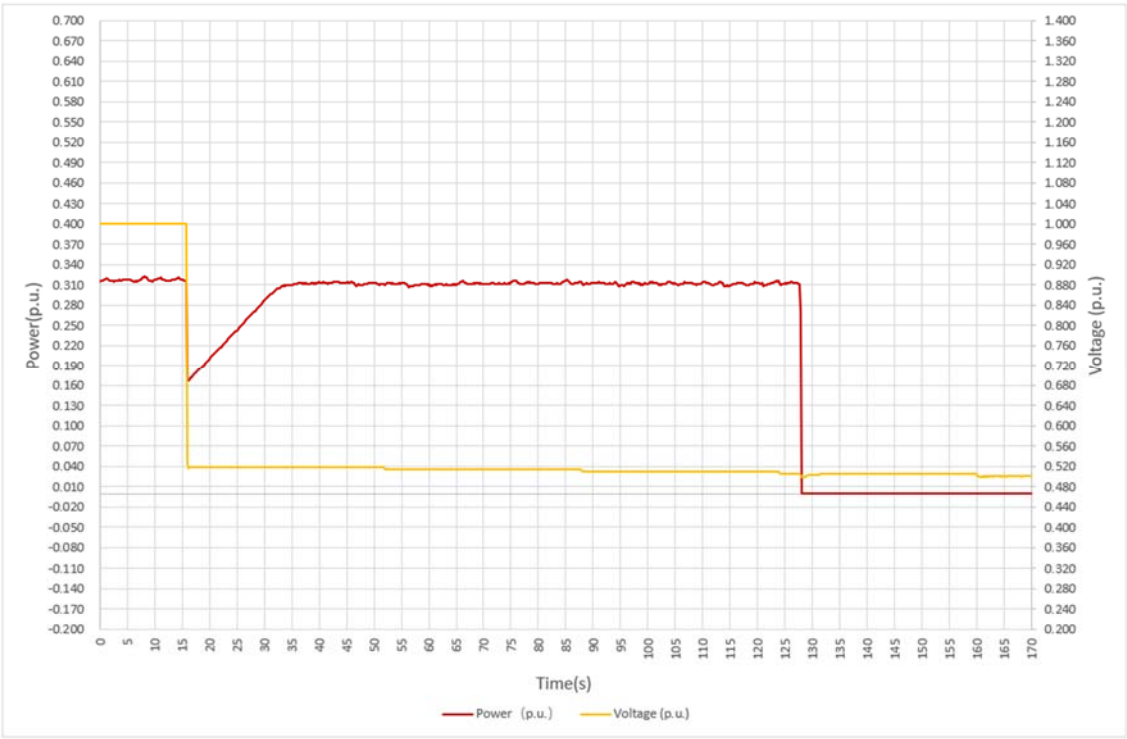


Disconnection Time

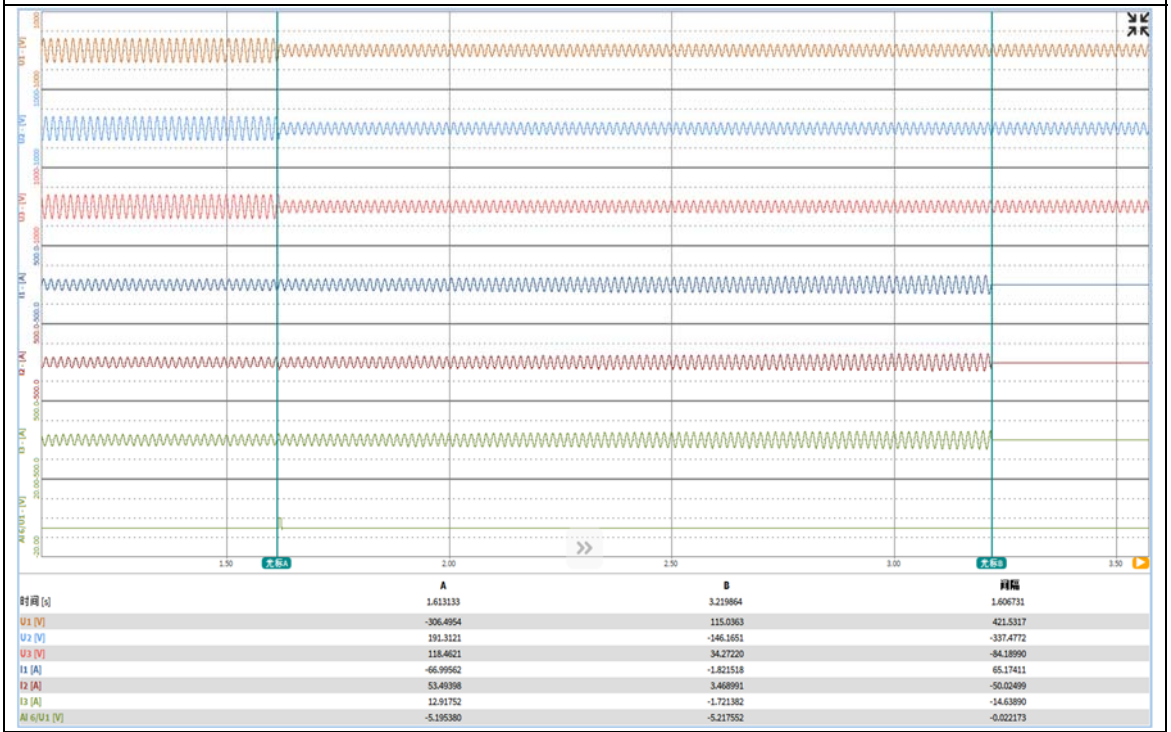
	A	B	间隔
时间 [s]	3.868154	5.841492	1.973338
U1 [V]	-283.0227	202.6012	485.6239
U2 [V]	21.89636	-134.0003	-155.8967
U3 [V]	255.6830	-69.29875	-324.9817
I1 [A]	-62.59680	-0.345707	62.25109
I2 [A]	16.23392	-0.181198	-16.41512
I3 [A]	46.62276	0.488758	-46.13400
AI 6/U1 [V]	-5.207777	-5.212307	-4.530e-3
P_t@POWERJAC [W]	29196.02	24597.30	-4598.719

50 %Vn ≤ V < 85 %Vn (setting at 111V) of 220V

Trip Value



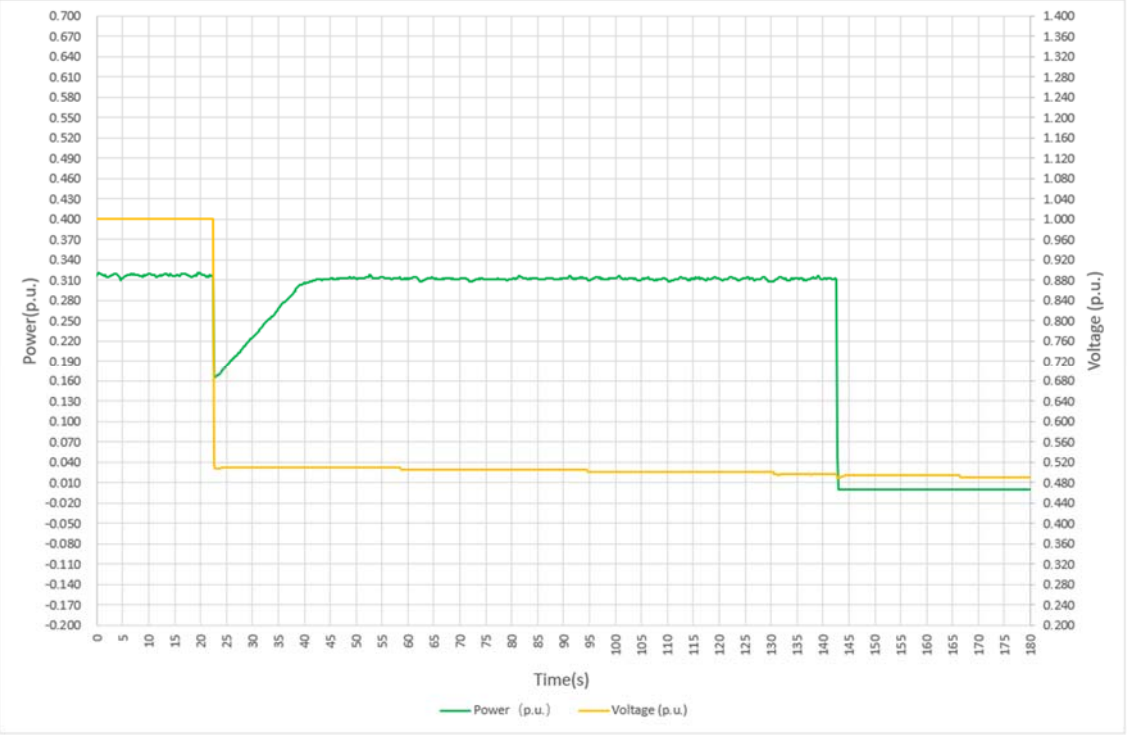
Disconnection Time



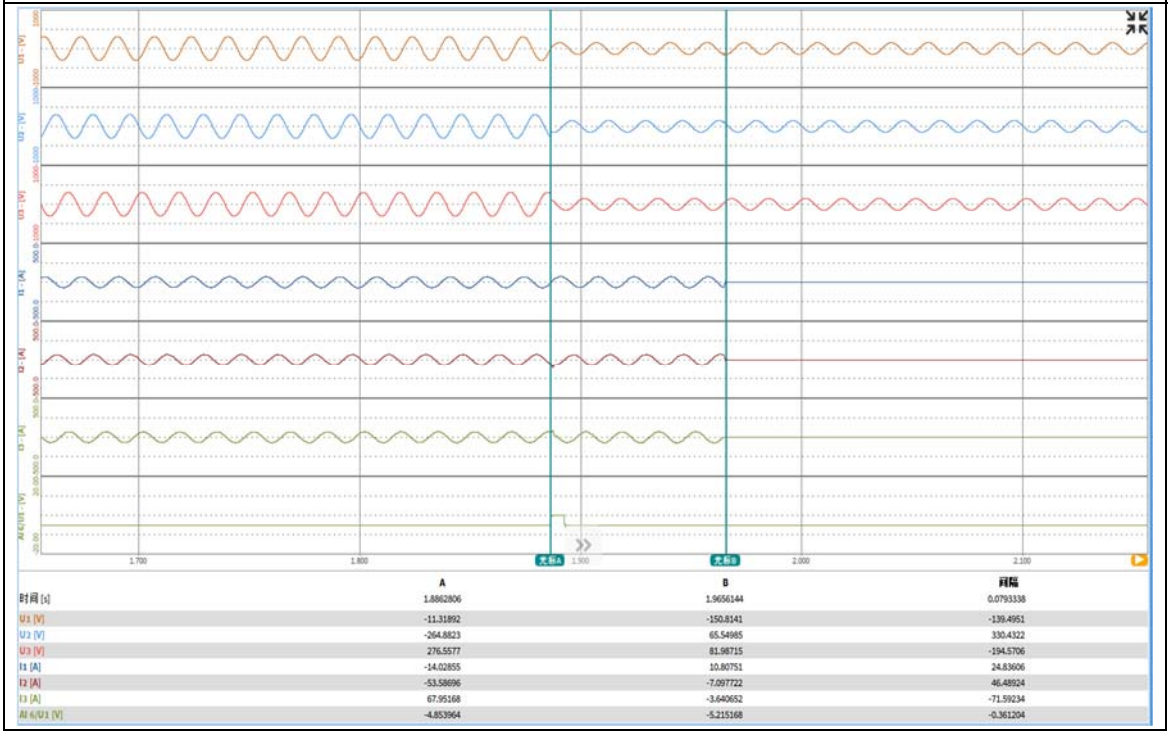
	A	B	間隔
時間 [s]	1.613133	3.219864	1.606731
U1 [V]	-306.4954	115.0363	421.5317
U2 [V]	191.3121	-146.1651	-337.4772
U3 [V]	118.4621	34.27220	-84.18990
I1 [A]	-66.99562	-1.821518	65.17411
I2 [A]	53.49398	3.468991	-50.02499
I3 [A]	12.91752	-1.721382	-14.63890
AI 6/U1 [V]	-5.195380	-5.217552	-0.022173

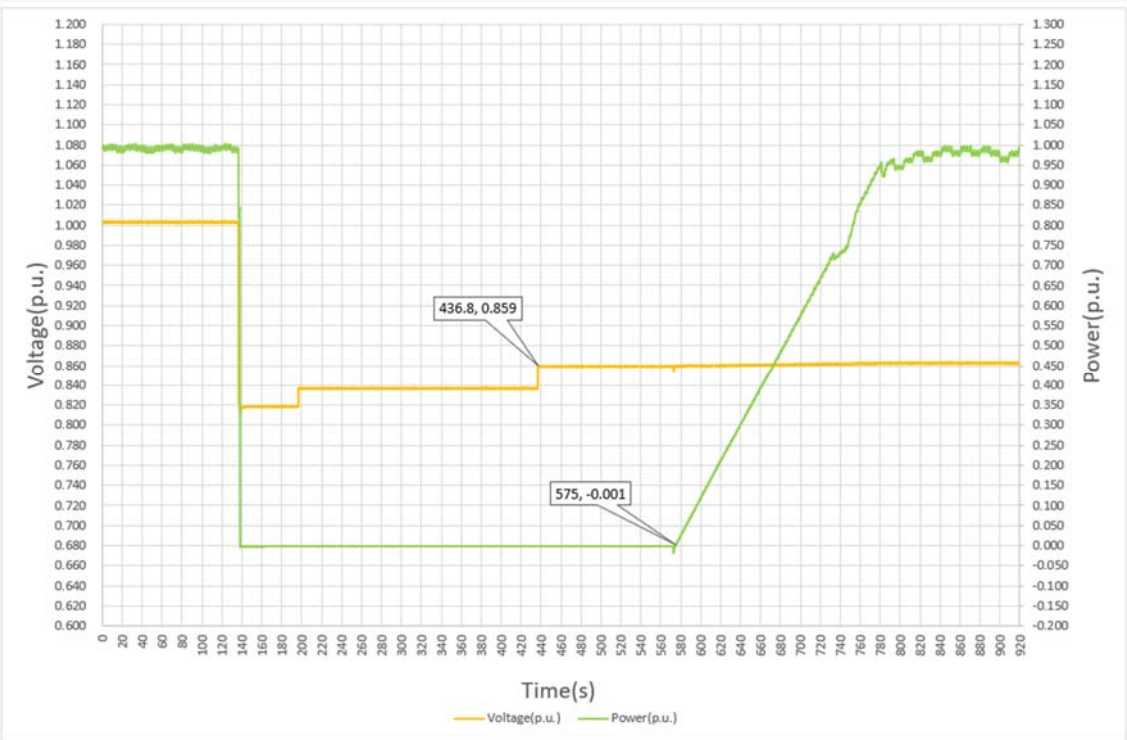
V < 50%Vn (setting at 109V) of 220V

Trip Value



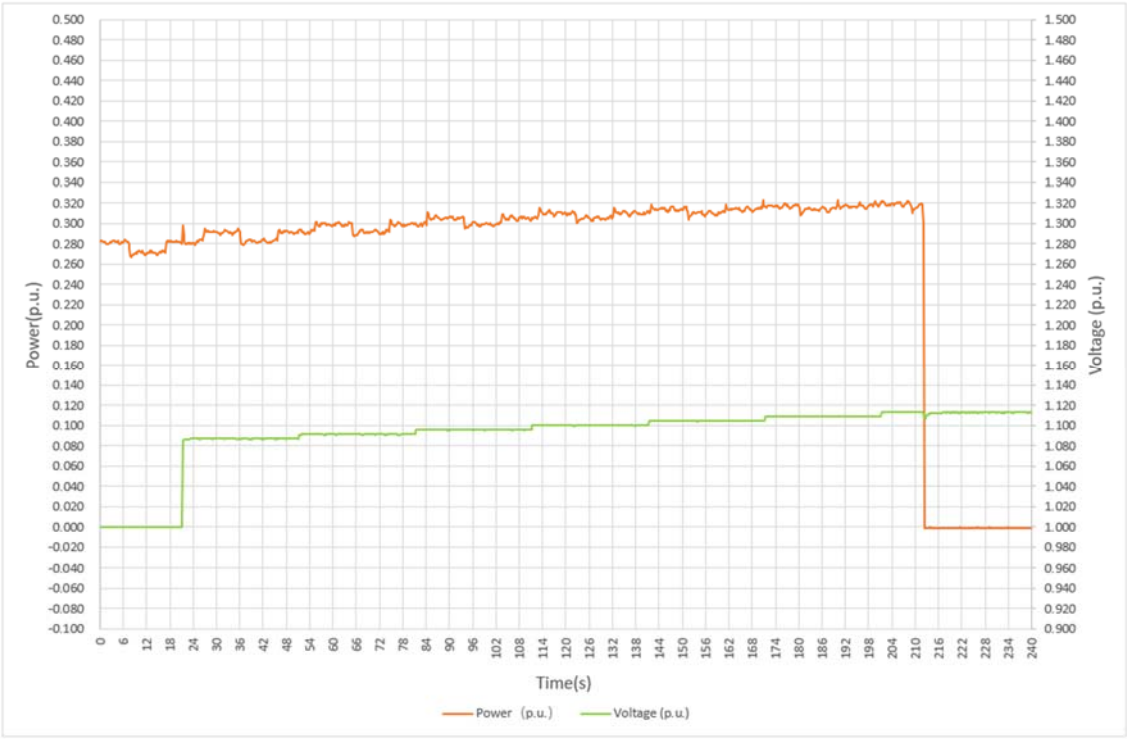
Disconnection Time



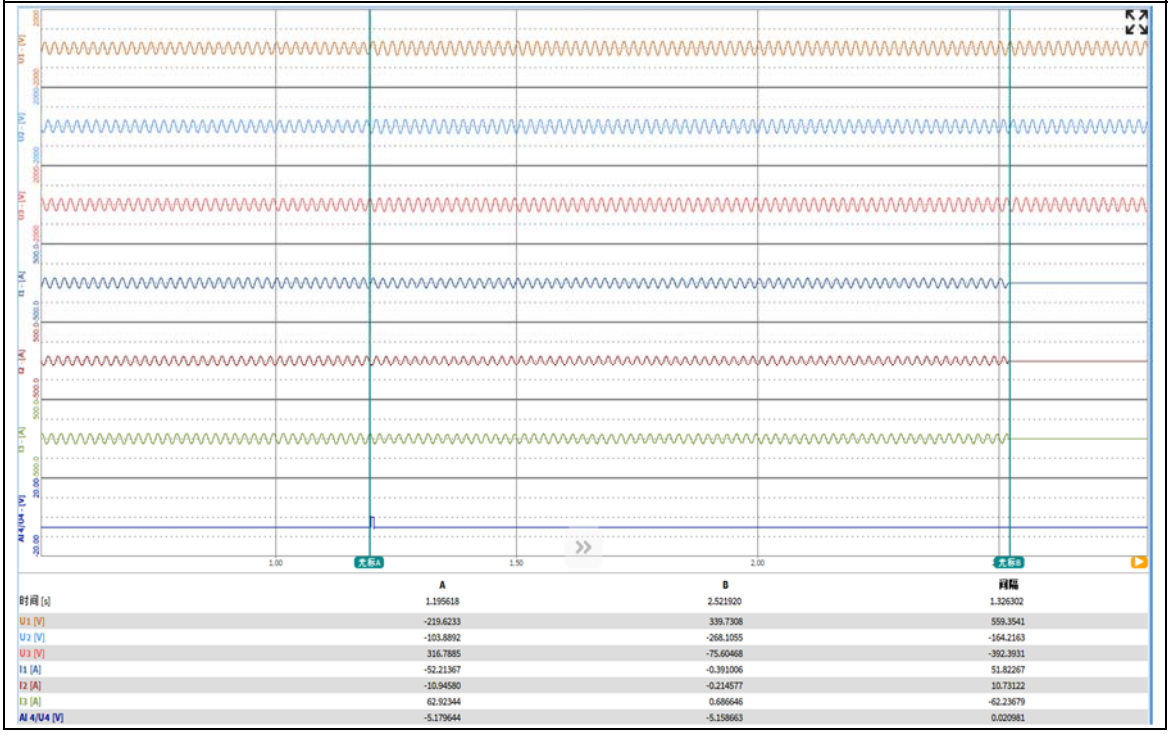
Under voltage Reconnection of 220V


110 %Vn < V < 135 %Vn(setting at 255V) of 230V

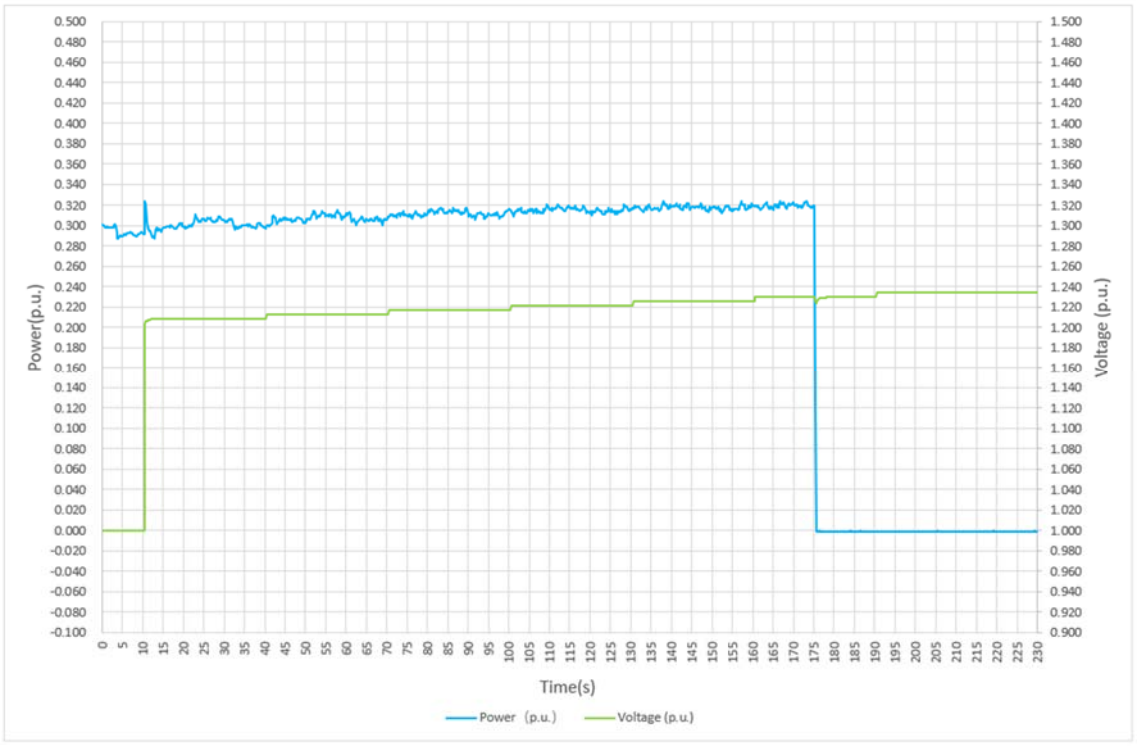
Trip value



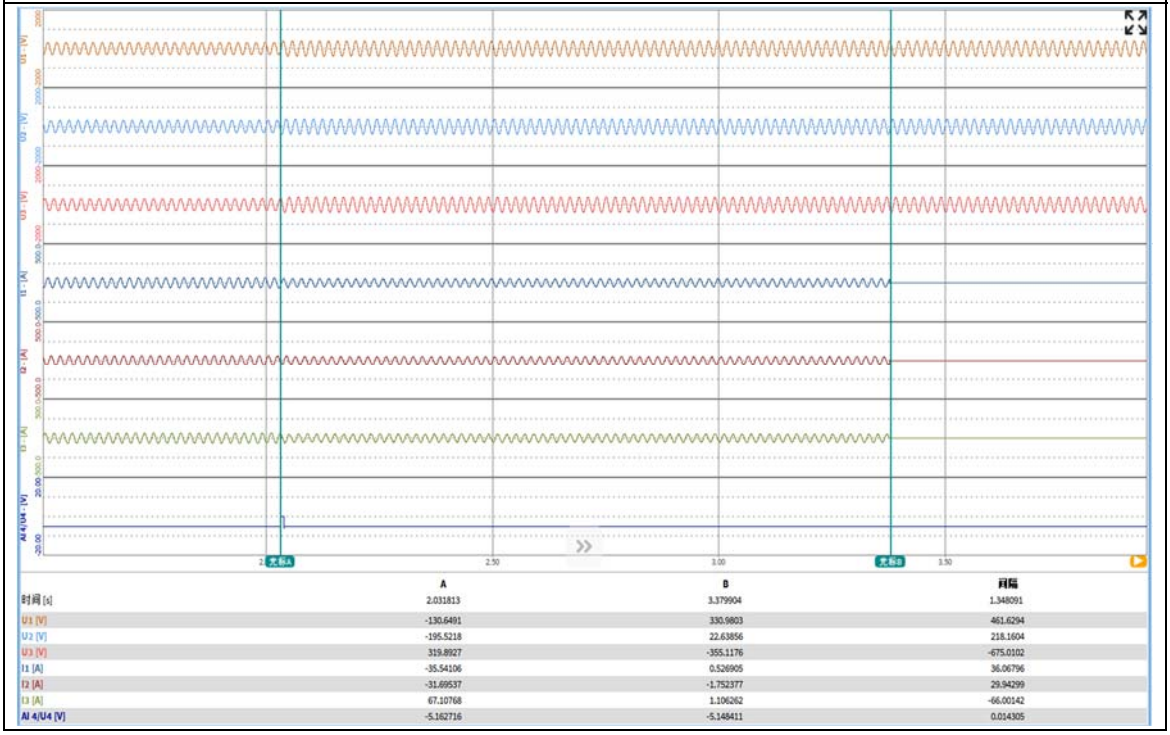
Disconnection Time



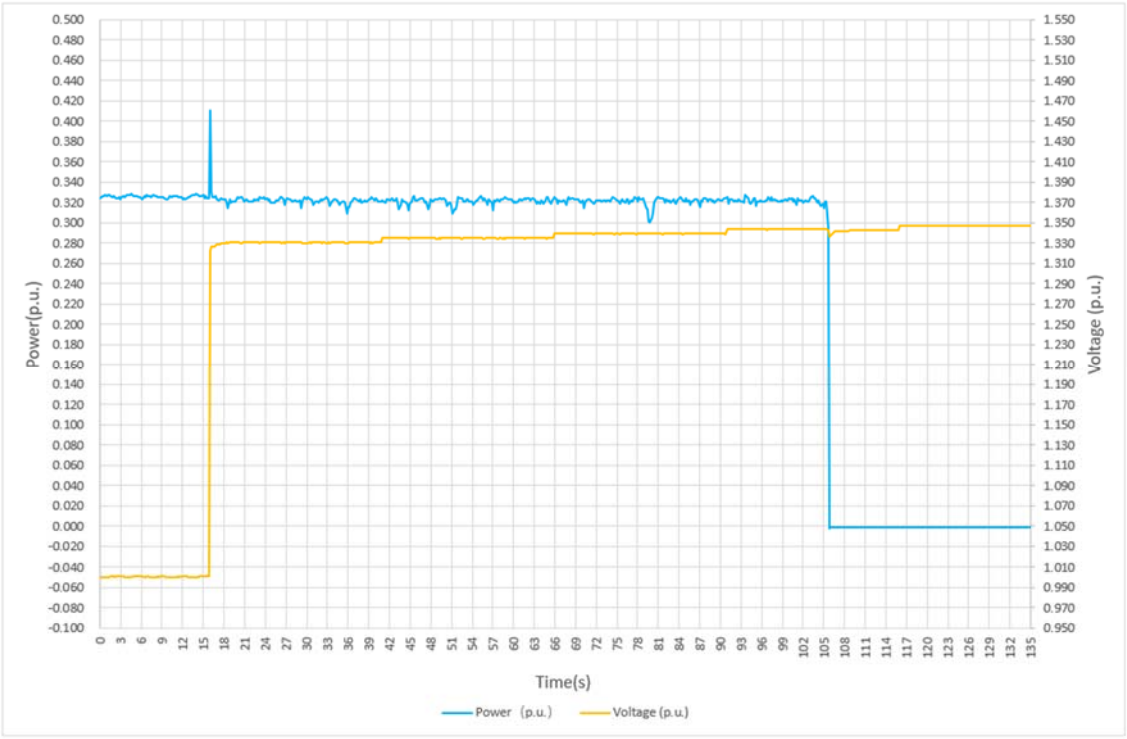
110 %Vn < V < 135 %Vn(setting at 282V) of 230V
Trip value



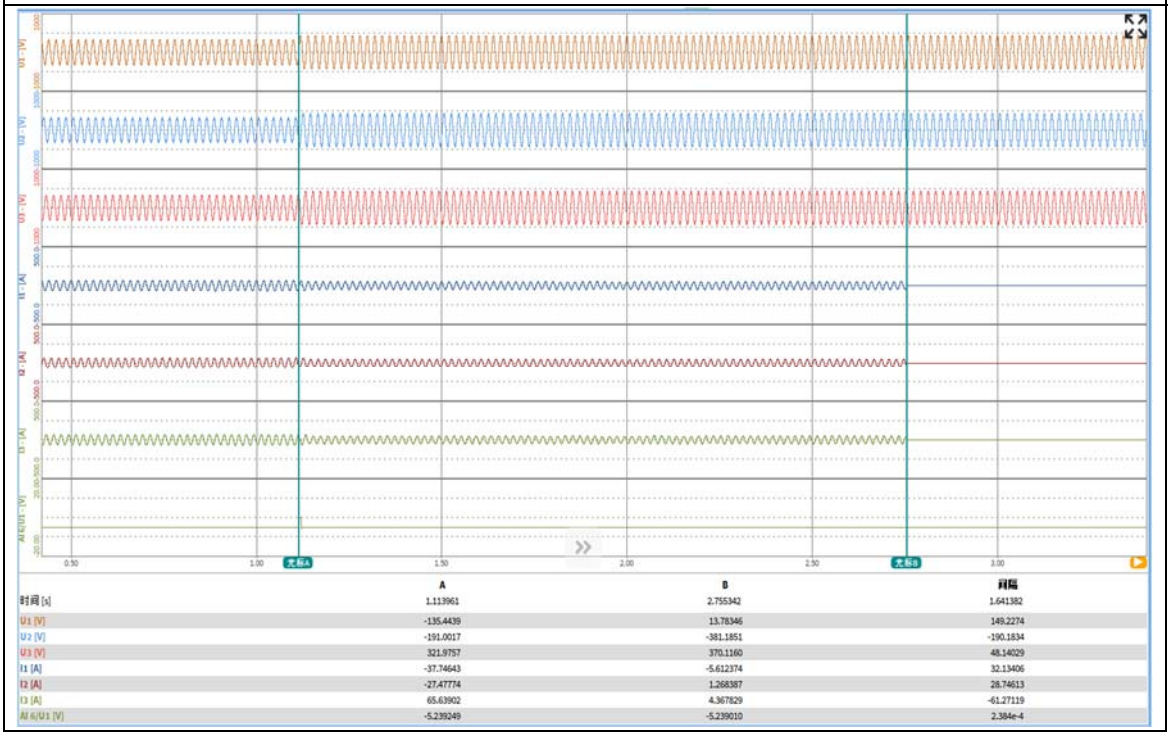
Disconnection Time



110 %Vn < V < 135 %Vn(setting at 309V) of 230V
Trip value

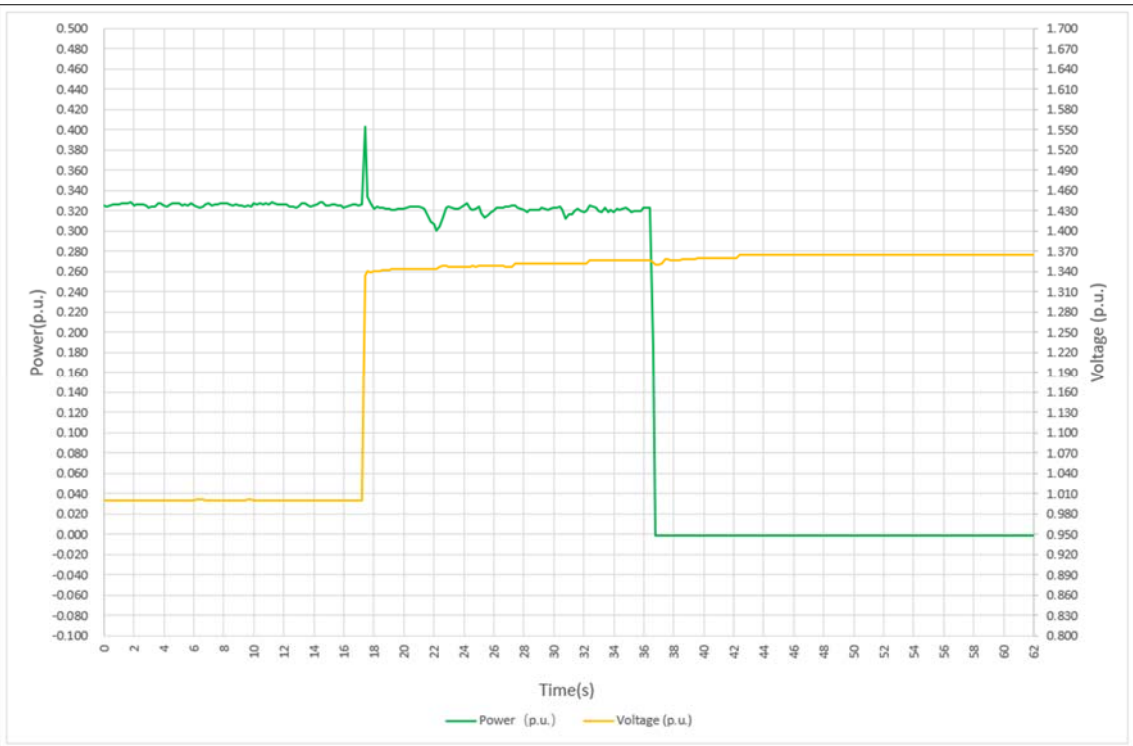


Disconnection Time

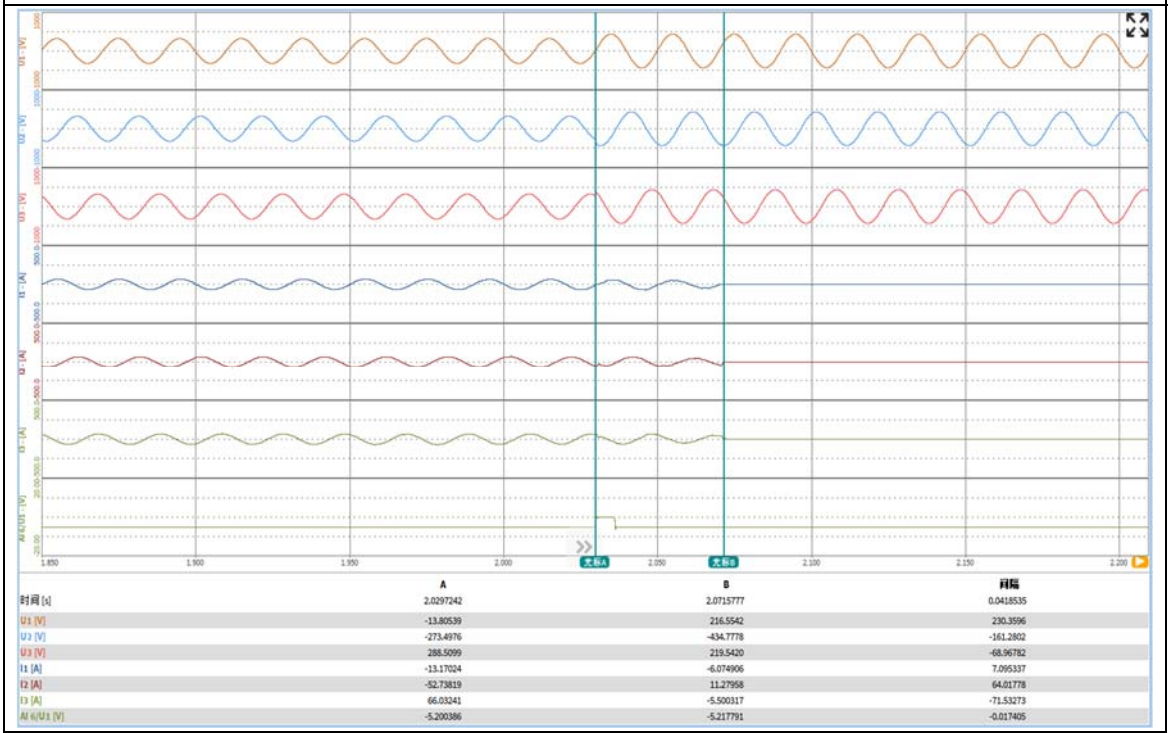


135%Vn ≤ V(setting at 312V) of 230V

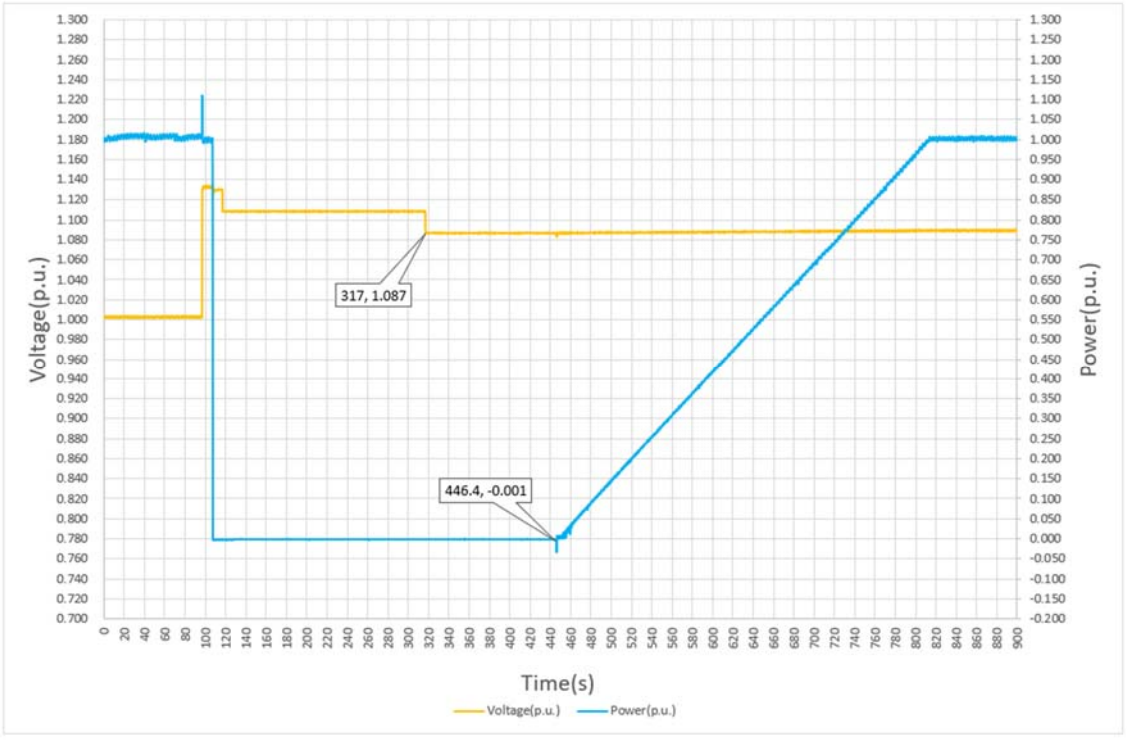
Trip value



Disconnection Time

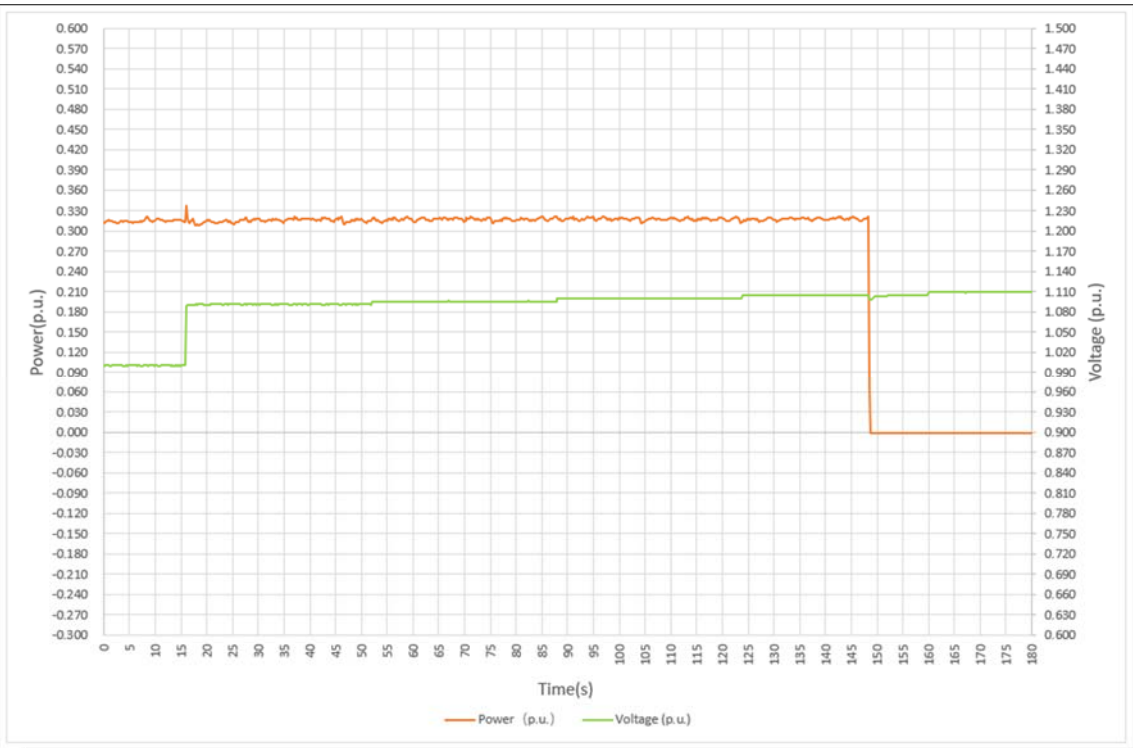


Over voltage reconnection of 230V

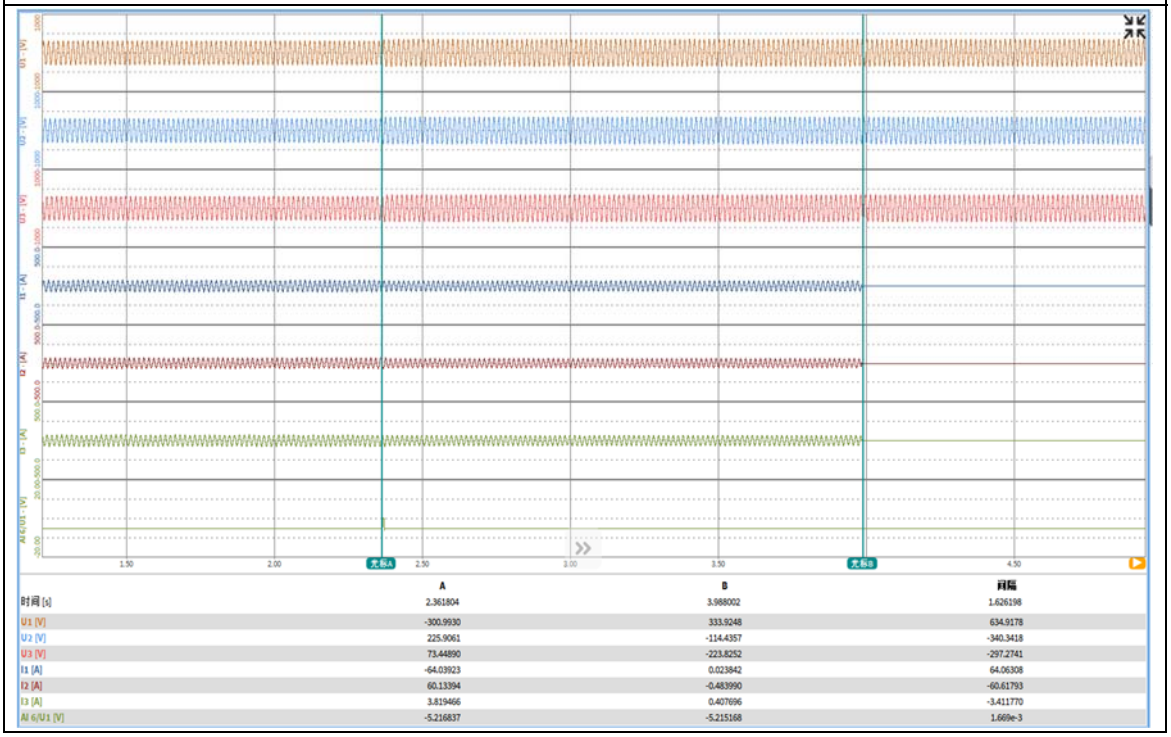


110 %Vn < V < 135 %Vn(setting at 241V) of 220V

Trip value

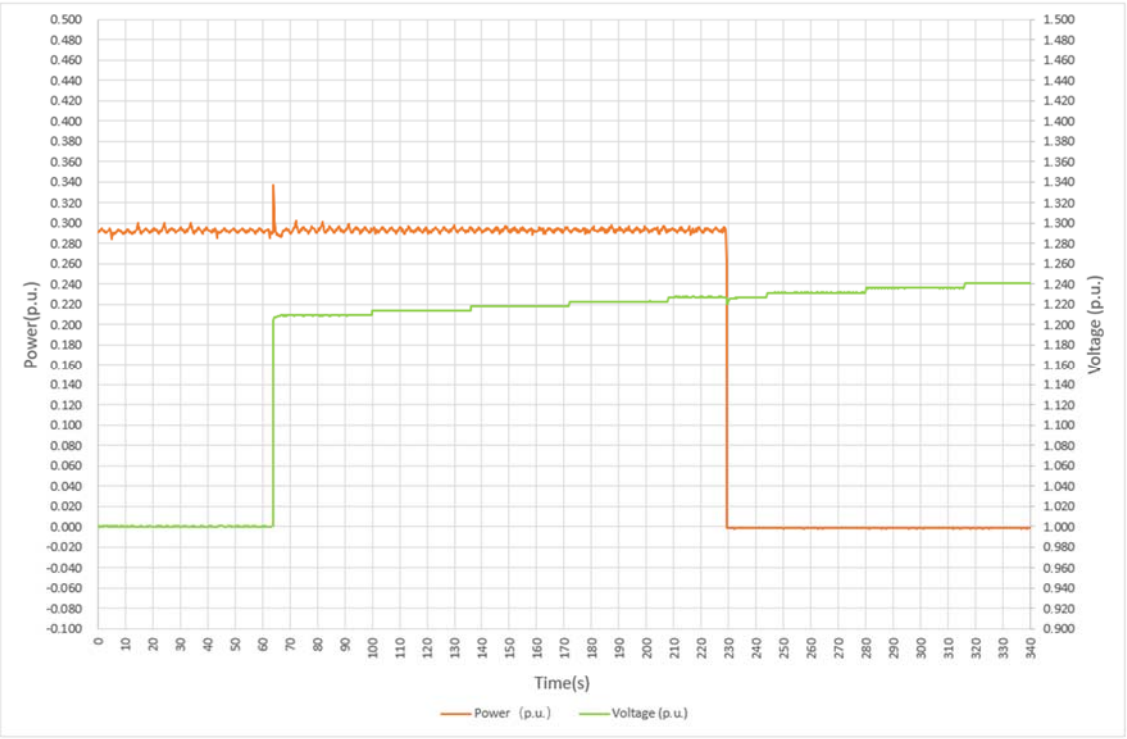


Disconnection Time

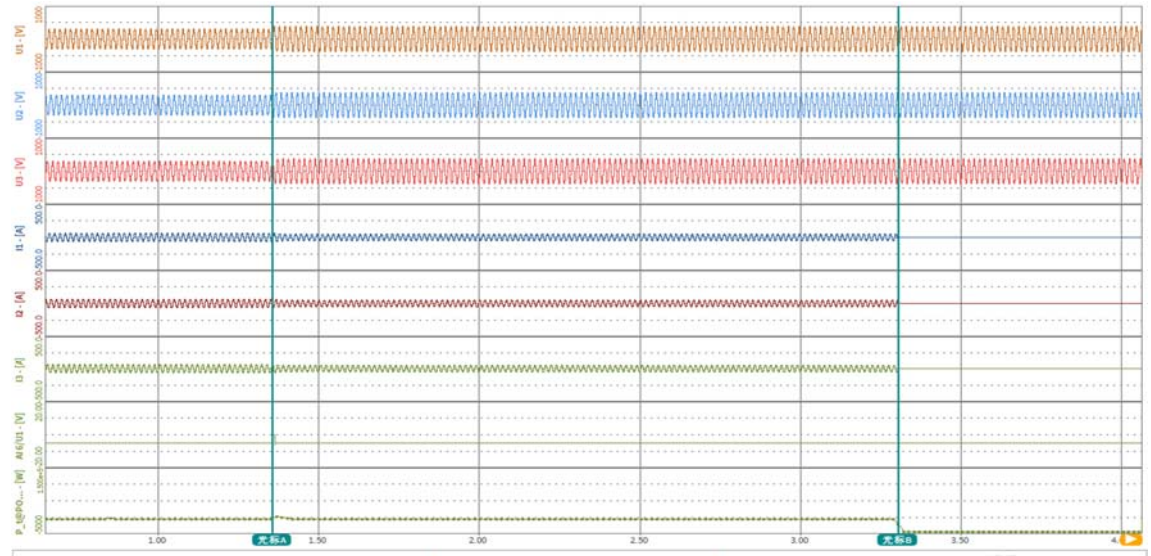


110 %Vn < V < 135 %Vn(setting at 270V) of 220V

Trip value



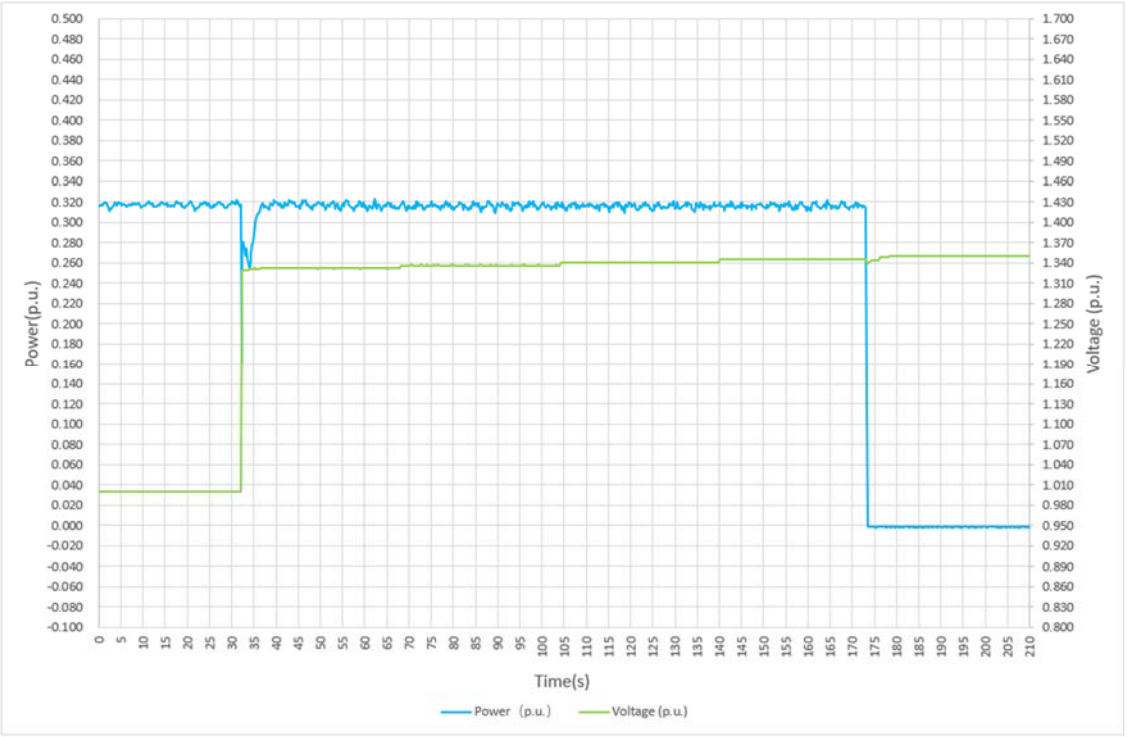
Disconnection Time



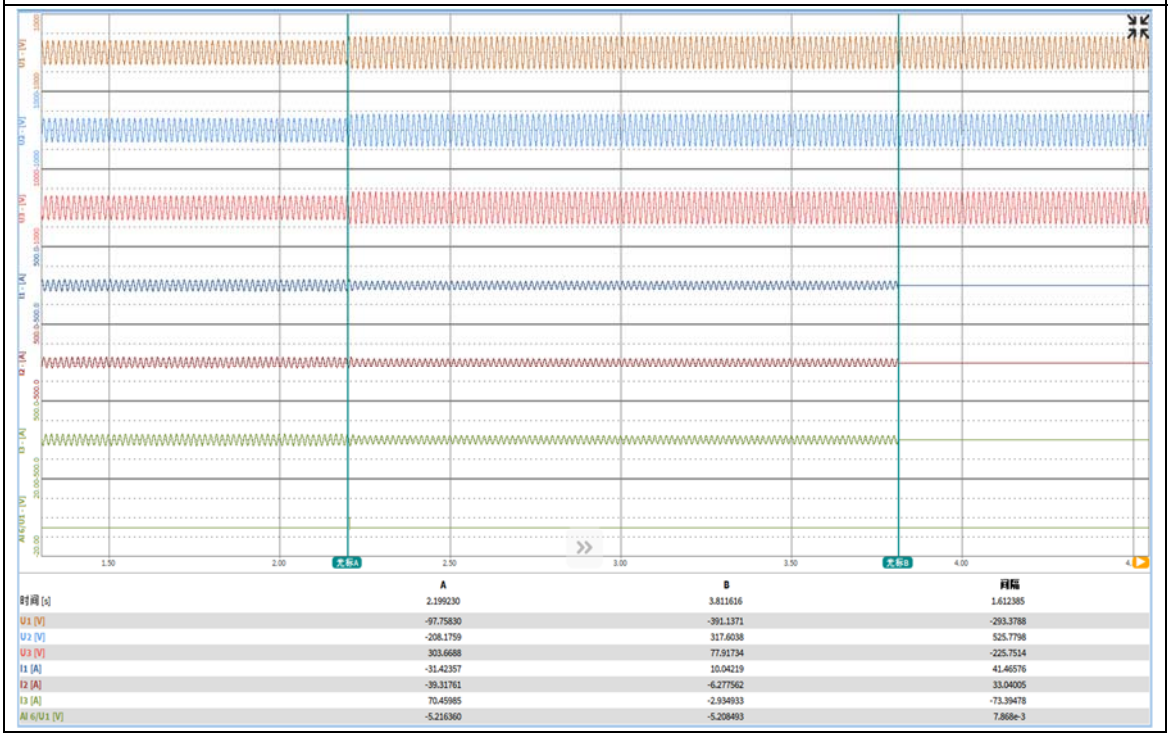
	A	B	间隔
时间 [s]	1.356659	3.302694	1.946035
U1 [V]	-216.0902	-293.4091	-77.31891
U2 [V]	-92.30900	359.5321	451.8411
U3 [V]	303.0610	-64.18395	-367.2450
I1 [A]	-48.91634	4.861355	53.77770
I2 [A]	-8.597374	-2.129078	6.468296
I3 [A]	57.55186	-2.696514	-60.24838
AI 6/U1 [V]	-5.219460	-5.225897	-6.437e-3
P_t@POWERJAC [W]	29412.87	29353.42	-59.44141

110 %Vn < V < 135 %Vn(setting at 296V) of 220V

Trip value



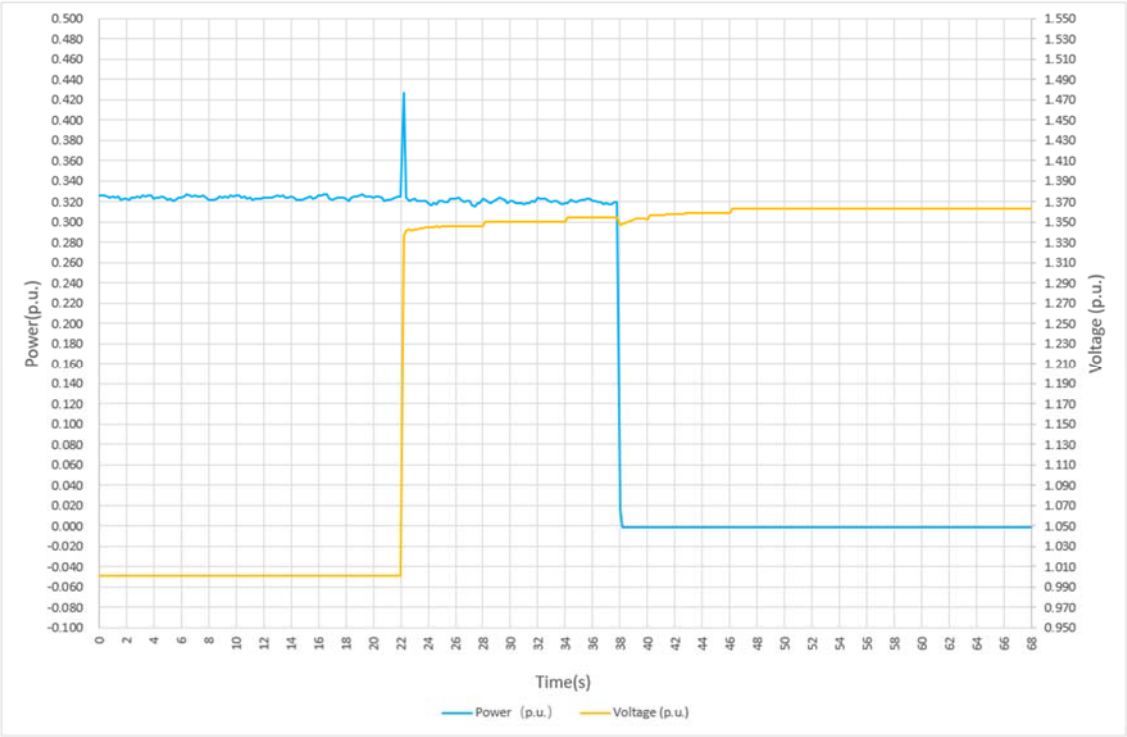
Disconnection Time



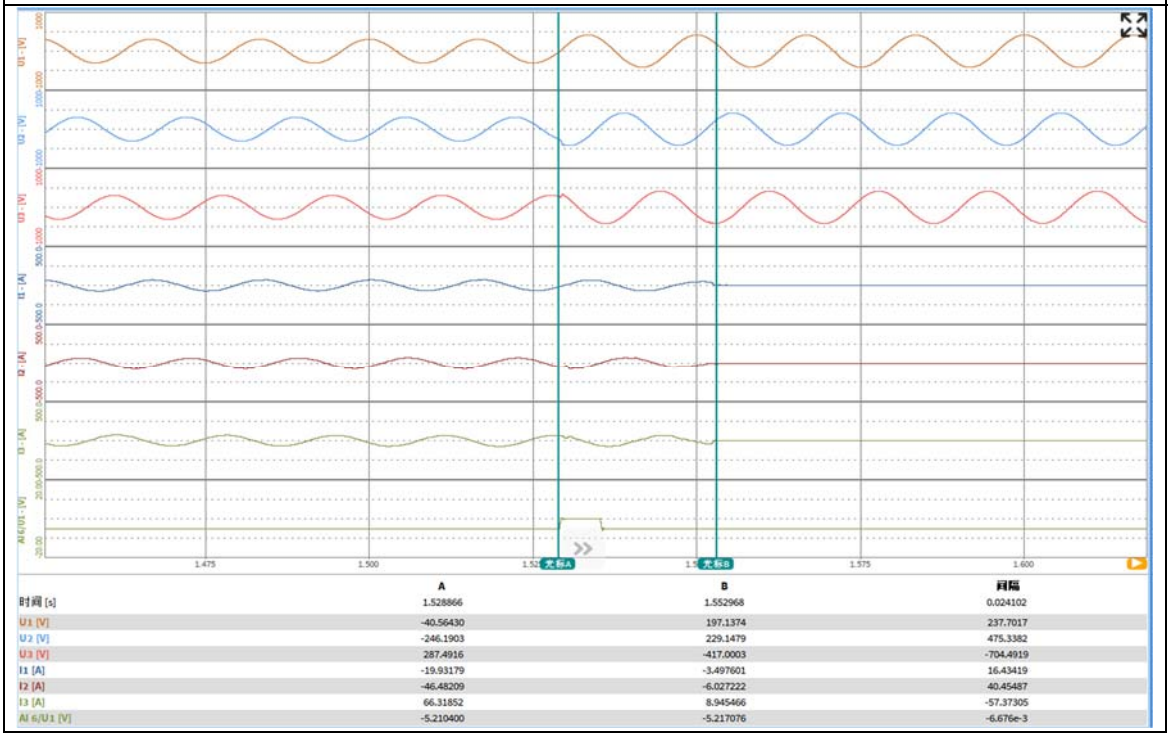
	A	B	间隔
时间 [s]	2.199230	3.811616	1.612385
U1 [V]	-97.75830	-391.1371	-293.3788
U2 [V]	-208.1759	317.6038	525.7798
U3 [V]	303.6688	77.91734	-225.7514
I1 [A]	-31.42357	10.04219	41.46576
I2 [A]	-39.31761	-6.277562	33.04005
I3 [A]	70.45985	-2.934933	-73.39478
AI 6/U1 [V]	-5.216360	-5.208493	7.868e-3

135%Vn ≤ V(setting at 298V) of 220V

Trip value

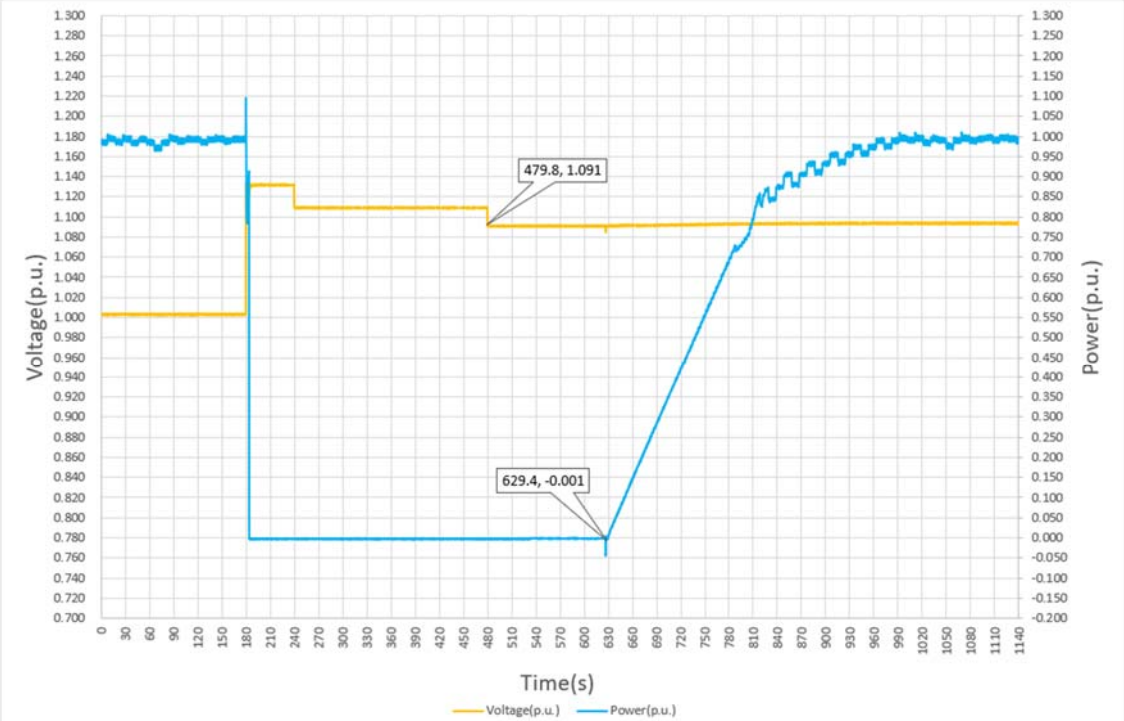


Disconnection Time

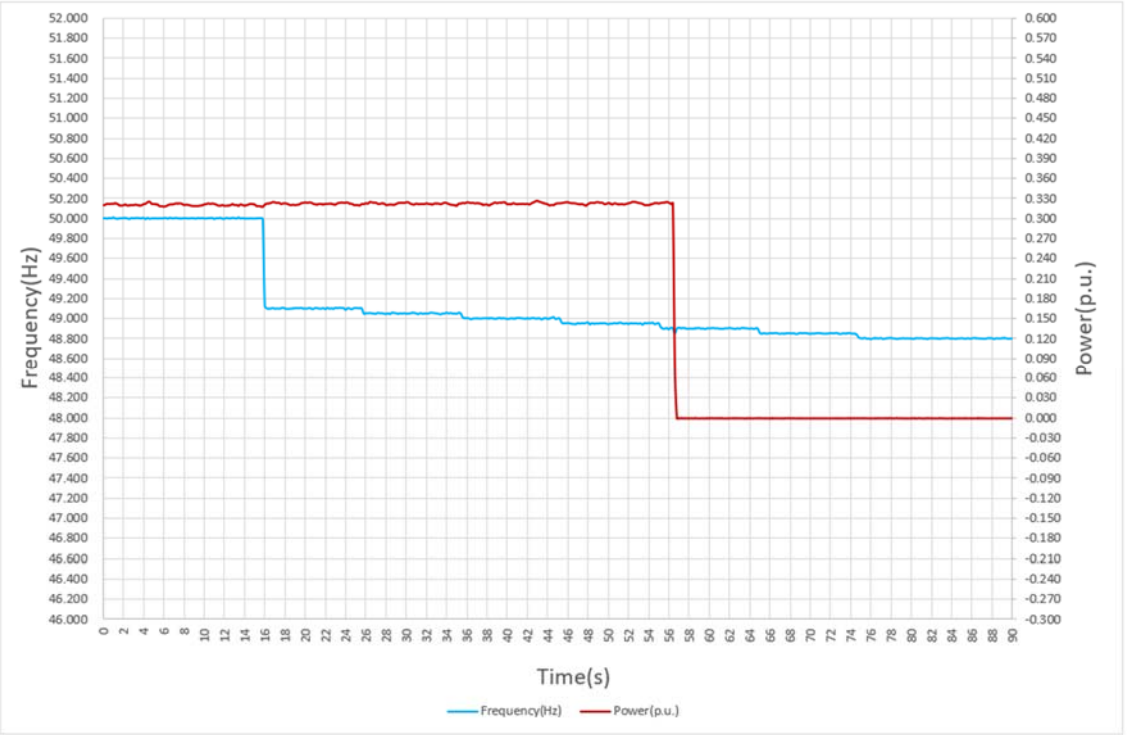
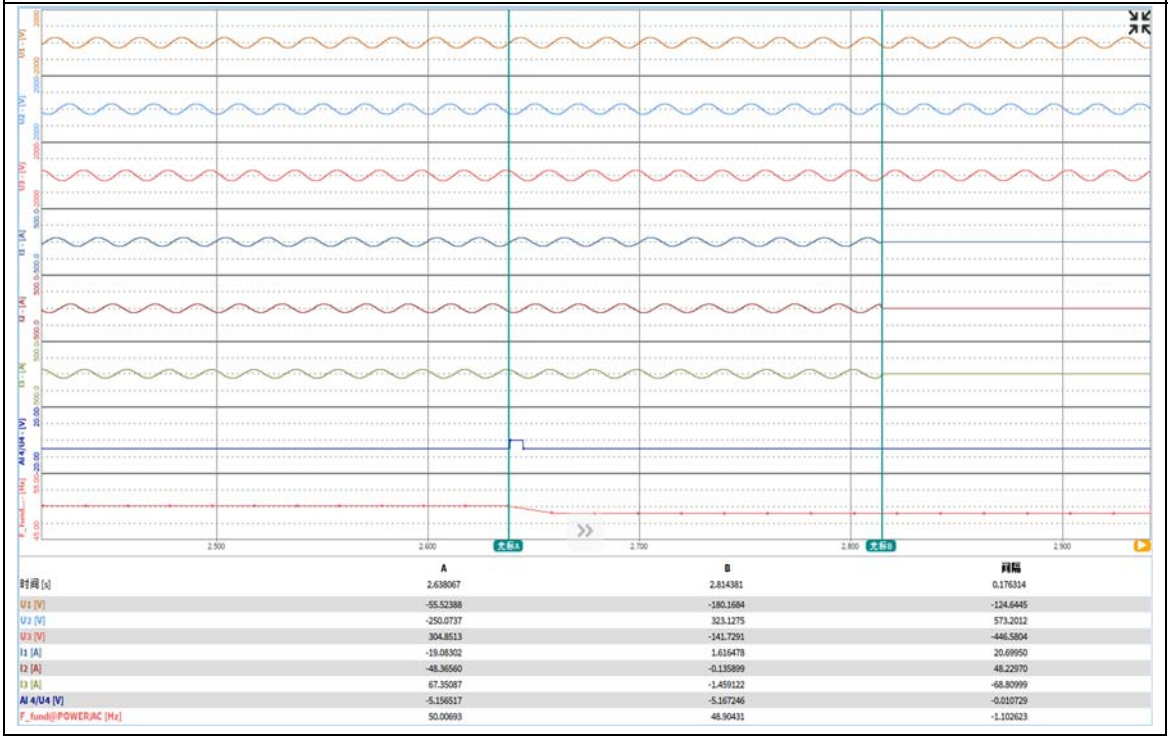


	A	B	间隔
时间 [s]	1.528866	1.552968	0.024102
U1 [V]	-40.56430	197.1374	237.7017
U2 [V]	-246.1903	229.1479	475.3382
U3 [V]	287.4916	-417.0003	-704.4919
I1 [A]	-19.93179	-3.497601	16.43419
I2 [A]	-46.48209	-6.027222	40.45487
I3 [A]	66.31852	8.945466	-57.37305
AI 6/U1 [V]	-5.210400	-5.217076	-6.676e-3

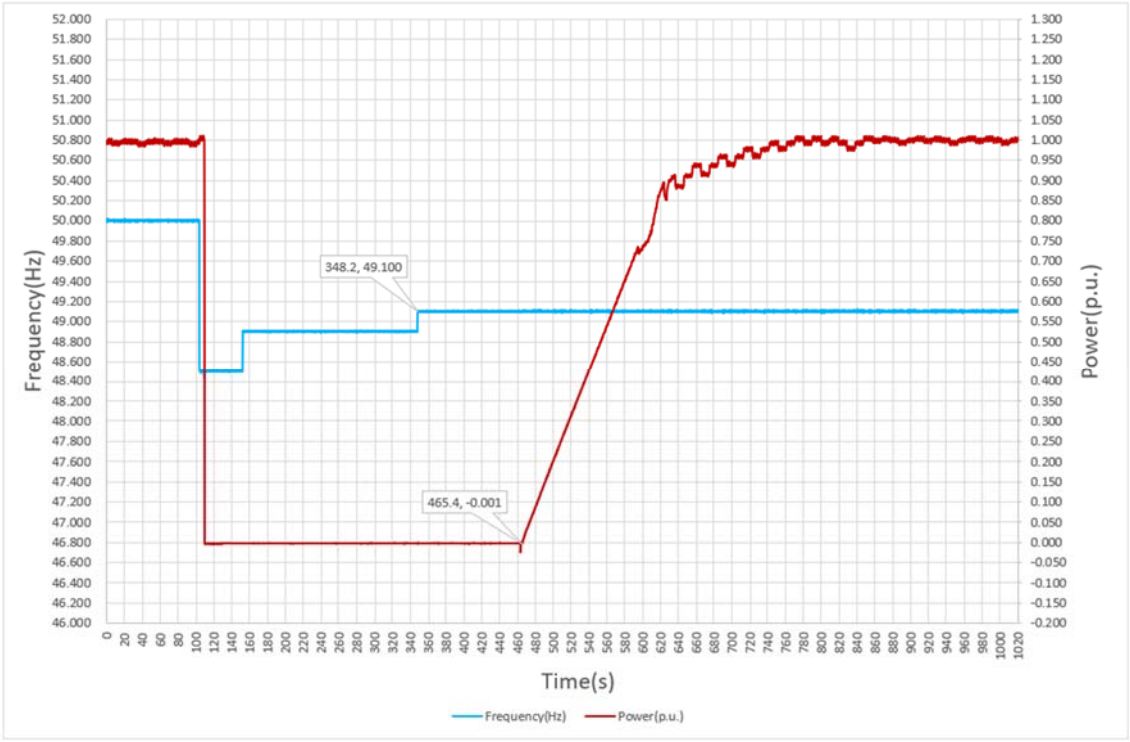
Over voltage reconnection of 220V

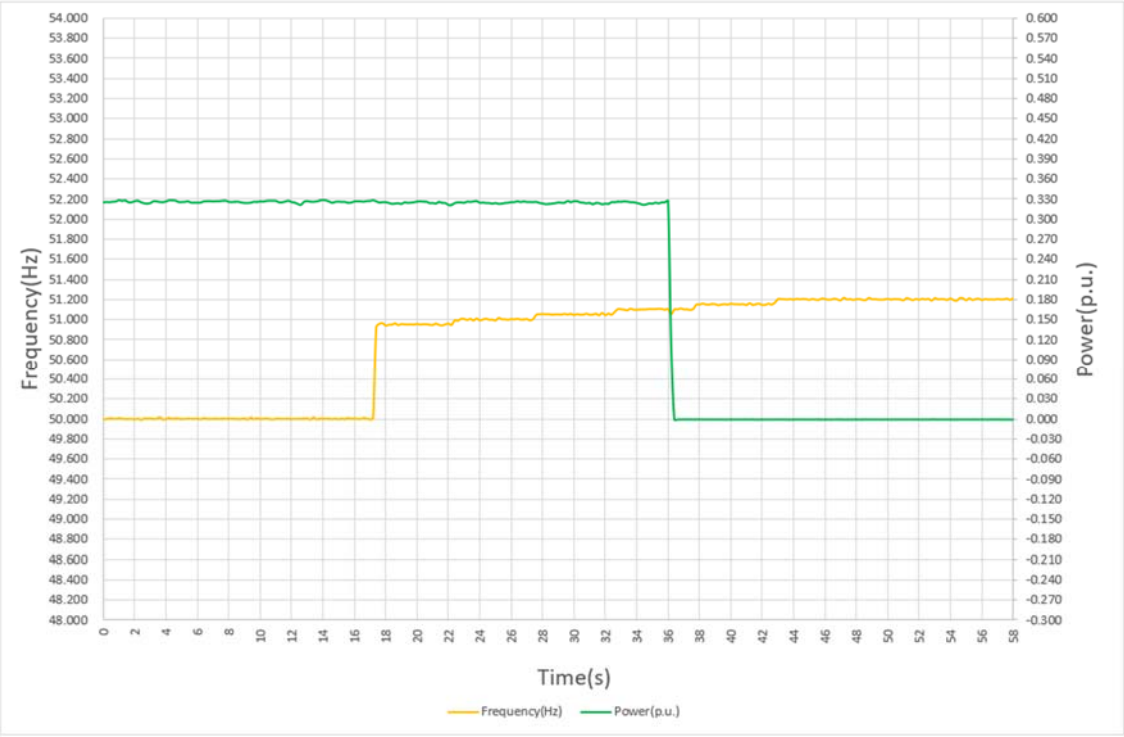
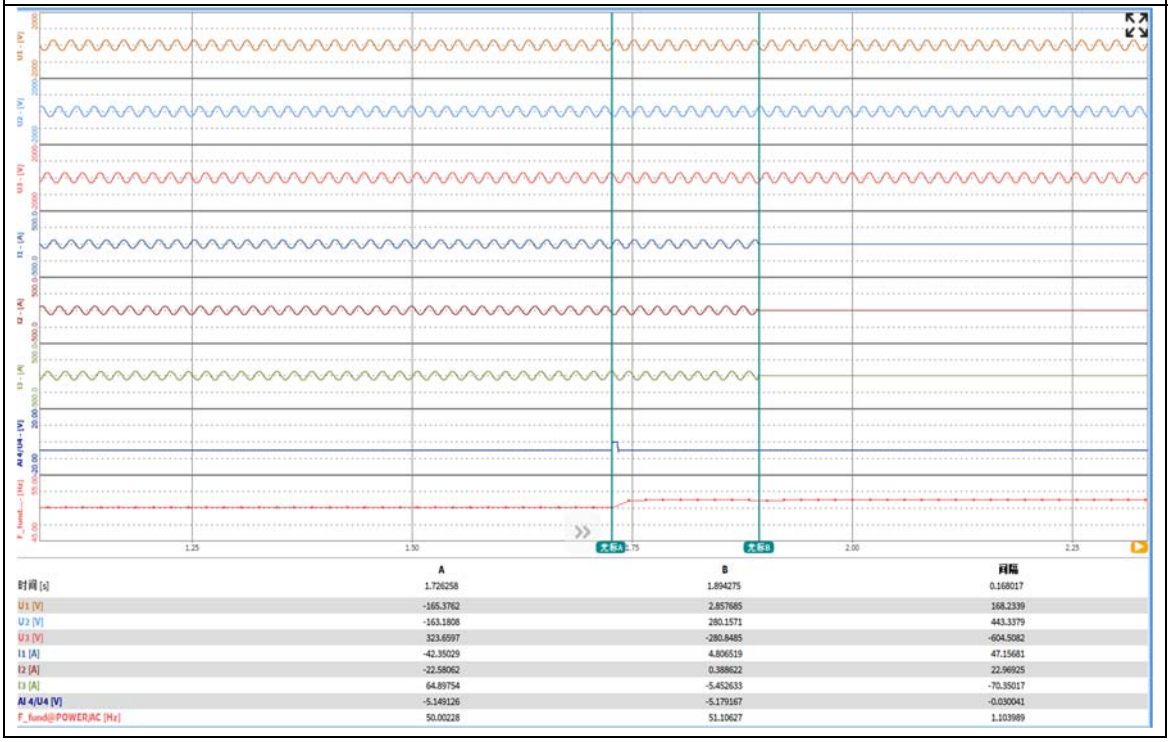


Over/under frequency trip settings and reconnection test

Under frequency of 50Hz
Trip value

Disconnection time


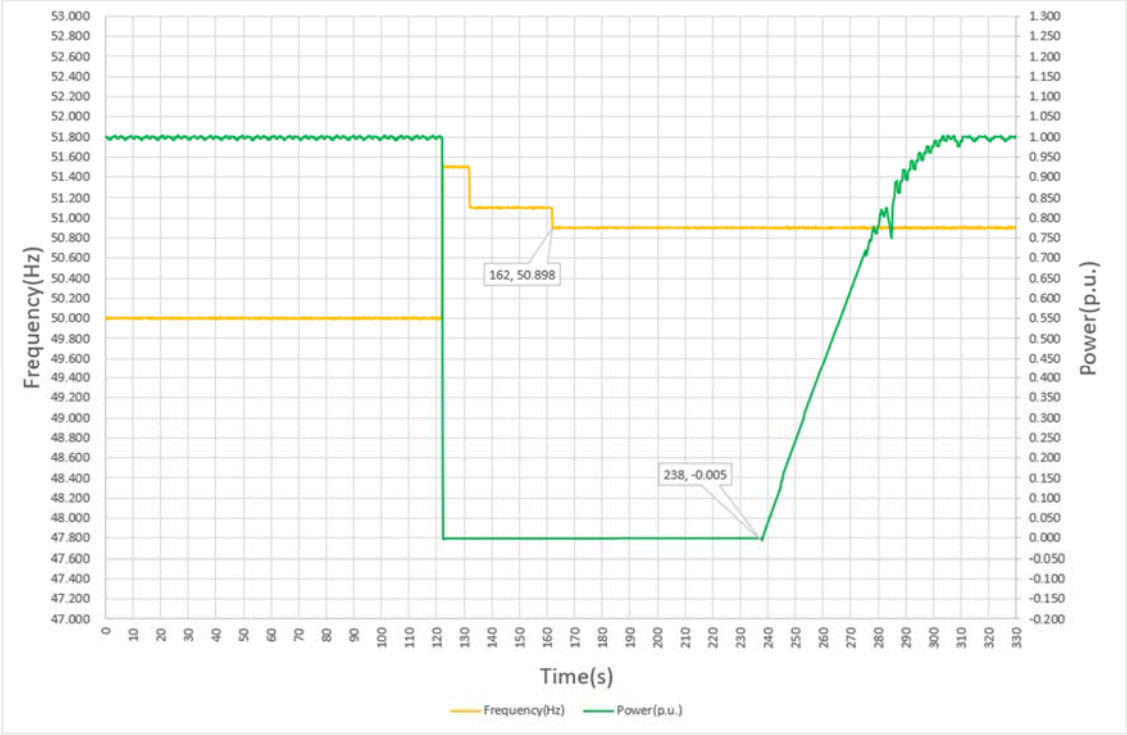
Under frequency reconnection of 50Hz



Over frequency of 50Hz
Trip value

Disconnection time


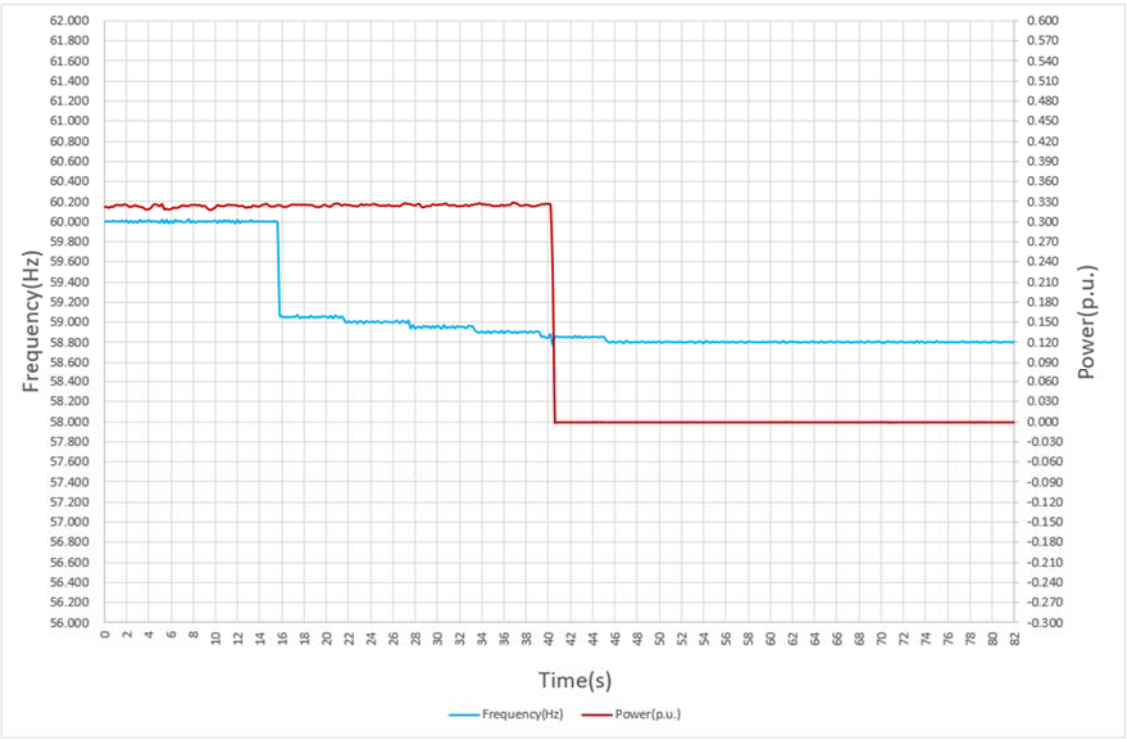
	A	B	间隔
时间 [s]	1.726258	1.894275	0.168017
U1 [V]	-165.3762	2.857685	168.2339
U2 [V]	-163.1808	280.1571	443.3379
U3 [V]	323.6597	-280.8485	-604.5082
I1 [A]	-42.35029	4.806519	47.15681
I2 [A]	-22.58062	0.388622	22.96925
I3 [A]	64.89754	-5.452633	-70.35017
AI 4/U4 [V]	-5.149126	-5.179167	-0.030041
F_fund@POWERIAC [Hz]	50.00228	51.10627	1.103989

Over frequency reconnection of 50Hz

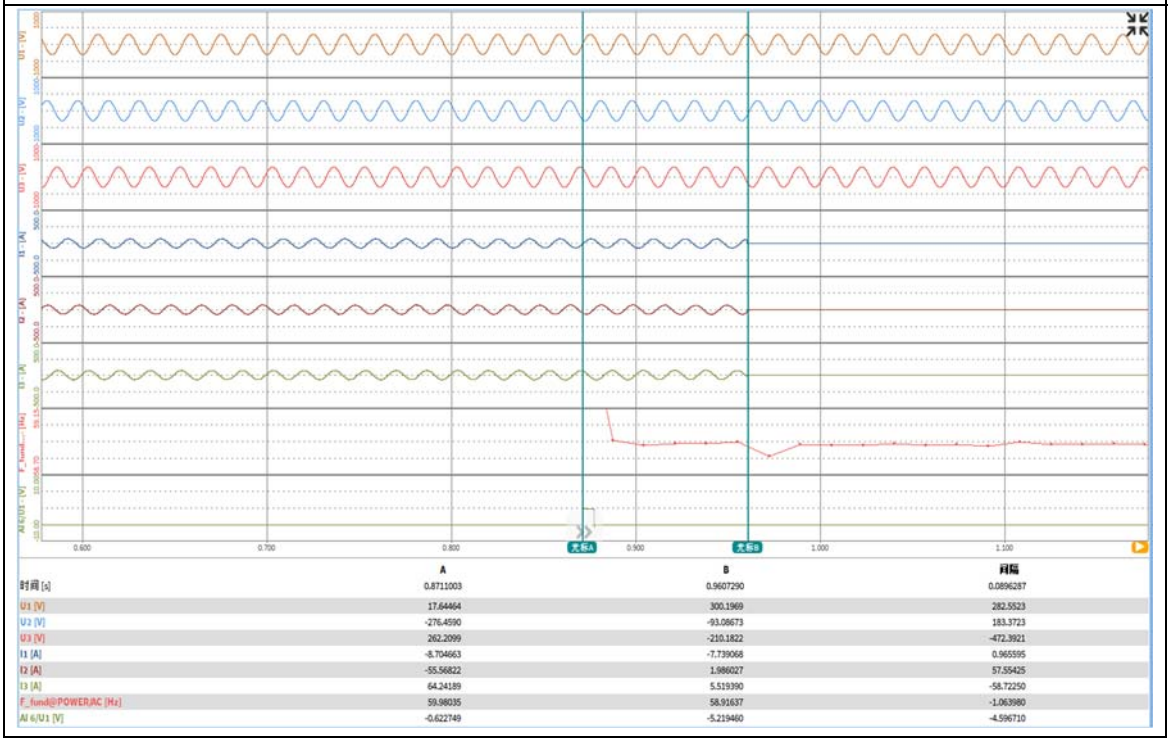


Under frequency of 60Hz

Trip value

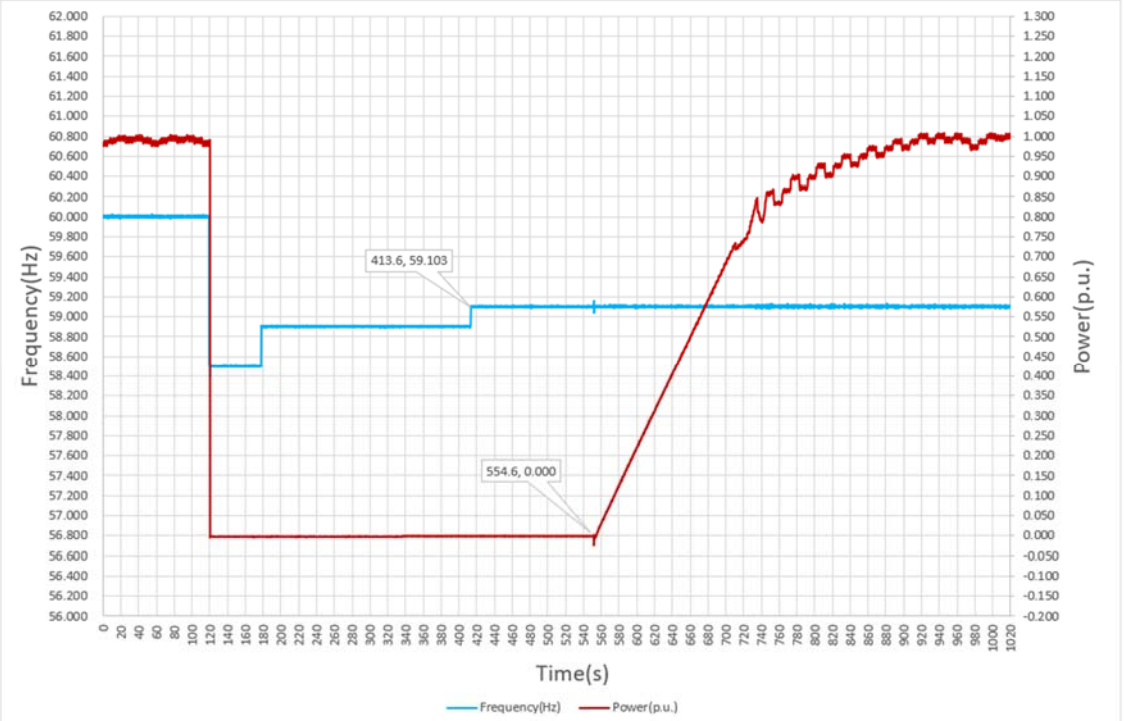


Disconnection time



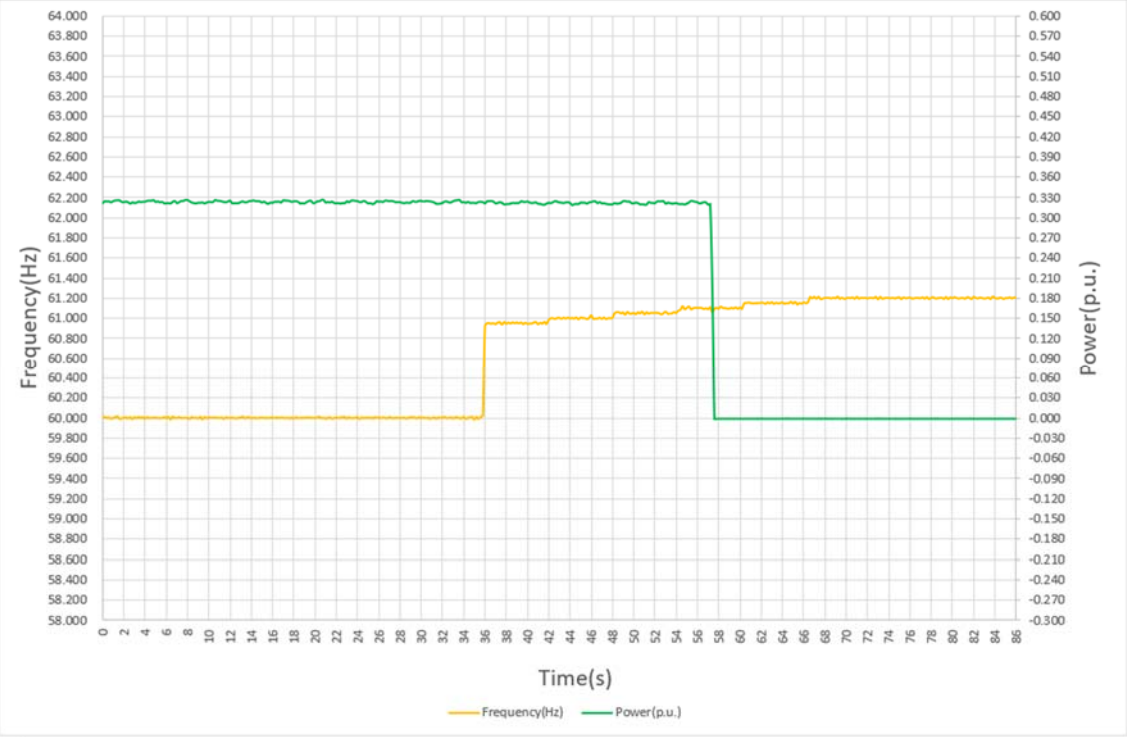
	A	B	间隔
时间 [s]	0.8711003	0.9607290	0.0896287
U1 [V]	17.64464	300.1969	282.5523
U2 [V]	-276.4590	-93.08673	183.3723
U3 [V]	262.2099	-210.1822	-472.3921
I1 [A]	-8.704663	-7.739068	0.965595
I2 [A]	-55.56822	1.986027	57.55425
I3 [A]	64.24189	5.519390	-58.72250
F_fund@POWER,AC [Hz]	59.98035	58.91637	-1.063980
AI 6/U1 [V]	-0.622749	-5.219460	-4.596710

Under frequency reconnection of 60Hz

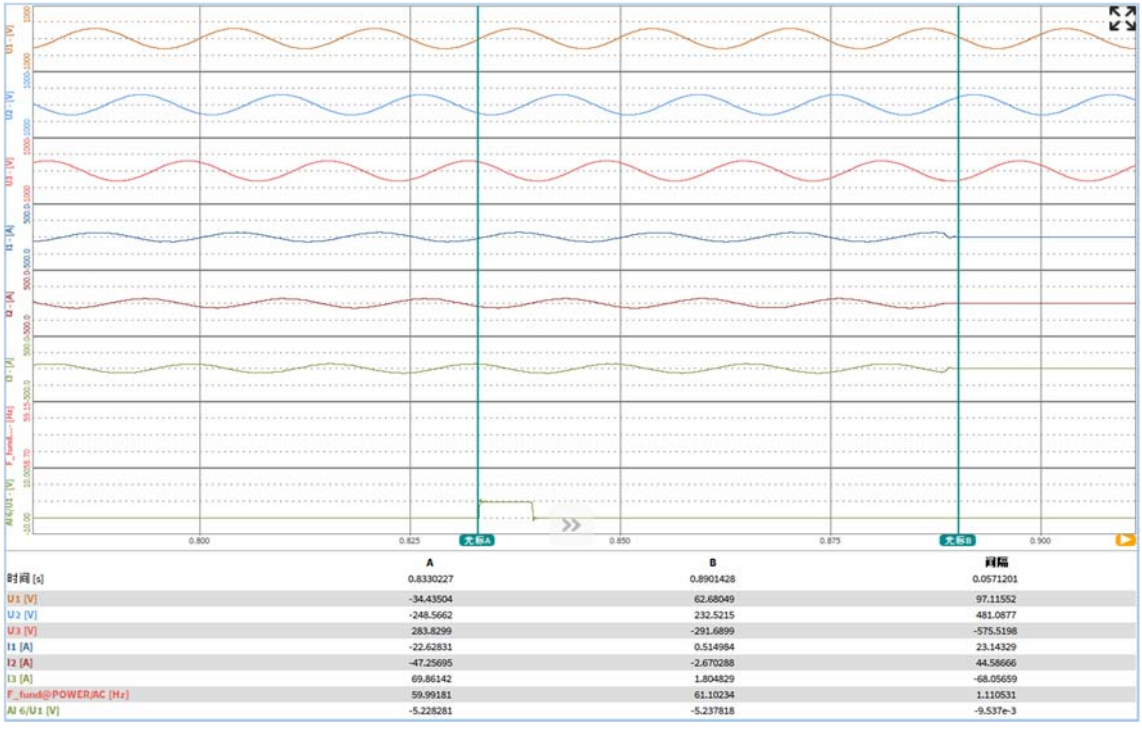


Over frequency of 60Hz

Trip value



Disconnection time



	A	B	间隔
时间 [s]	0.8330227	0.8901428	0.0571201
U1 [V]	-34.43504	62.68049	97.11552
U2 [V]	-248.5662	232.5215	481.0877
U3 [V]	283.8299	-291.6899	-575.5198
I1 [A]	-22.62831	0.514984	23.14329
I2 [A]	-47.25695	-2.670288	44.58666
I3 [A]	69.86142	1.804829	-68.05659
F_fund@POWER/AC [Hz]	59.99181	61.10234	1.110531
AI 6/U1 [V]	-5.228281	-5.237818	-9.537e-3

Over frequency reconnection of 60Hz