TESTING FOR THE VERIFICATION OF COMPLIANCE OF PV INVERTER WITH:

IEC 60068-2-1, Environmental Testing. Part 2-1: Tests. Test Ae: Cold.

IEC 60068-2-2, Environmental Testing. Part 2-2: Tests. Test Be: Dry heat.

IEC 60068-2-14, Environmental Testing. Part 2-14: Tests. Test Nb: Change of temperature.

IEC 60068-2-30, Environmental Testing. Part 2-30: Tests. Test Db-Variant 1: Damp heat, cyclic (12 h + 12 h cycle).

Procedure: PE.T-LE-62

Test Report Number	:	GZES201103204504
Trademark	:	EVVO
Tested Model	:	E- 100KTL
Variant Models	:	E- 75KTL, E- 80KTL, E- 110KTL E- 100KTL-HV, E- 125KTL-HV, E- 136KTL-HV

APPLICANT

Name	:	EVOLVE ENERGY GROUP CO., LIMITED
Address	:	RM 702,7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN,HK

TESTING LABORATORY

Name	:	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch
Address	:	198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China
Conducted (tested) by	:	Hugo Zhang (Project Engineer)
Approved by	:	Roger Hu (Project Engineer)
Date of issue	:	09 / 12 / 2020
Number of pages	:	35

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Test Report Historical Revision:

Test Report Version	Date	Resume
GZES201103204504	09 / 12 / 2020	This report is modification of test report number GZES201203336804

INDEX

1 SCOPE

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch has been contract by EVOLVE ENERGY GROUP CO., LIMITED in order to perform the testing according to the following Standards:

- IEC 60068-2-1:2007, Environmental Testing. Part 2-1: Tests. Test Ae: Cold.
- IEC 60068-2-2:2007, Environmental Testing. Part 2-2: Tests. Test Be: Dry heat.
- IEC 60068-2-14:2009, Environmental Testing. Part 2-14: Tests. Test Nb: Changes of temperature.
- IEC 60068-2-30:2005, Environmental Testing. Part 2-30: Tests. Test Db – Variant 1: Damp heat, cyclic (12 h + 12 h).

2 GENERAL INFORMATION

2.1 Testing Period and Climatic conditions

The necessary testing has been performed along between the 03th to 10th of August of 2020.
Laboratory ambient temperature tests and checks have been performed at 25 ± 5ºC, 96 kPa ± 10 kPa and 50% RH ± 10% RH.

SITE TEST

Name ..... : **Dongguan BALUN Technology Co., Ltd.**

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

2.2 Equipment under Testing

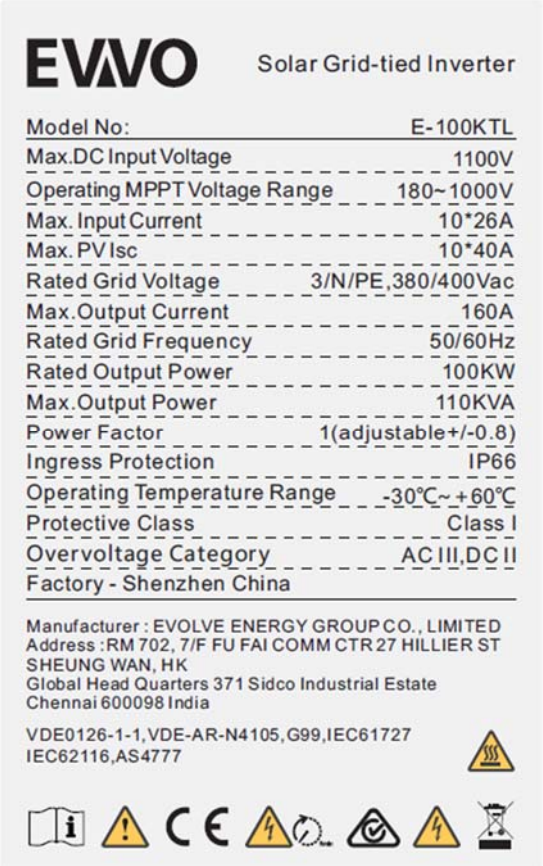
Apparatus type ..... :	Solar Grid-tied Inverter
Installation ..... :	Fixed(permanent connection)
Manufacturer ..... :	EVOLVE ENERGY GROUP CO., LIMITED
Trade mark ..... :	EVVO
Model / Type reference ..... :	E- 100KTL
Serial Number..... :	SQ1ES1A0L85001
Software Version ..... :	ARM V020010 DSPS V020010 DSPM V020010
Rated Characteristics ..... :	DC input: 180V-1000V Max.10 x 26 A AC output: 3/N/PE 230Va.c, 50Hz, 3 x 144.9A (Max.3 x160A), 100KW

Date of manufacturing: 2020

Test item particulars

Input..... :	DC
Output.....	AC
Class of protection against electric shock ... :	Class I
Degree of protection against moisture ..... :	IP 66
Type of connection to the main supply..... :	TN
Cooling group ..... :	Fans
Modular..... :	No
Internal Transformer ..... :	No

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.

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						
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

The results obtained apply only to the particular sample tested that is the subject of the present test report. The most unfavorable result values of the verifications and tests performed are contained herein.
Throughout this report a point (~~comma~~) is used as the decimal separator

2.3 Test equipment list

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

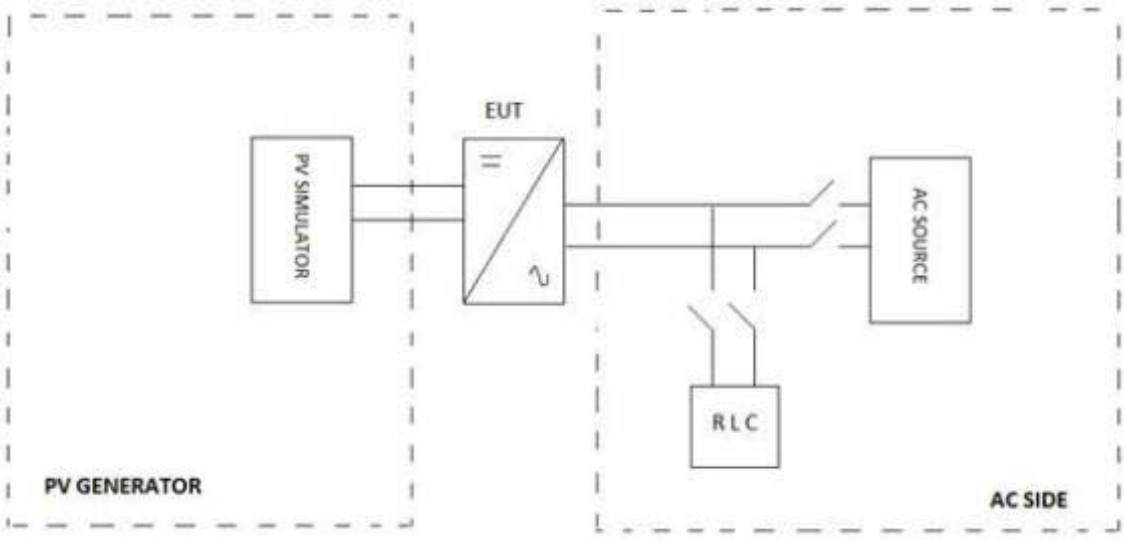
2.4 Measurement uncertainty

Associated uncertainties through measurements showed in this this report are the maximum allowable uncertainties.

Magnitude	**Uncertainty**
Voltage measurement uncertainty	±1.5 %
Current measurement uncertainty	±2.0 %
Frequency measurement uncertainty	±0.2 %
Time measurement uncertainty	±0.2 %
Power measurement uncertainty	±2.5 %
Phase Angle	±1%
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 solicitant.	

2.5 Test set up of the different standard

The test bench used includes:



Different equipment has been used to take measures as it shows in chapter 2.3. Current and voltage clamps have been connected to the inverter output for all the tests.

All the tests described in the following pages have used this specified test setup.

2.6 Definitions

EUT	Equipment Under Testing	Hz	Hertz
A	Ampere	V	Volt
VAr	Volt-Ampere reactive	W	Watt
Un	Nominal Voltage	p.u	Per unit
In	Nominal Current	Pn	Nominal Active Power
Ia	Active Current	Qn	Nominal Reactive Power
Ir	Reactive Current	Sn	Nominal Apparent Power
MV	Medium Voltage	ºC	Celsius degree
LV	Low Voltage	K	Kelvin degree
RH	Relative Humidity		

3 RESUME OF TEST RESULTS

INTERPRETATION KEYS

Test object does meet the requirement..... **P** Pass
Test object does not meet the requirement..... **F** Fails
Test case does not apply to the test object..... **N/A** Not applicable
To make a reference to a table or an annex. ..... See additional sheet
To indicate that the test has not been realized ..... **N/R** Not realized

TEST AND CHECKS			
Point	**Standard**	**Test procedure**	
4.1	**IEC 60068-2-1**	Test Ae: Cold	P
4.2	**IEC 60068-2-2**	Test Be: Dry heat.	P
4.3	**IEC 60068-2-14**	Test Nb: Change of temperature.	P
4.4	**IEC 60068-2-30**	Test Db: Damp heat, cyclic	P

Note: The declaration of conformity has been evaluated taking account the IEC Guide 115.

4 TEST RESULTS

4.1 TEST AE: COLD

The test purpose is the determination of the aptitude of the components, equipment and other items for use, transport or store at low temperature, according to the standard IEC 60068-2-1. Environmental testing. Part 2-1: Test. Test A: Cold.

Due to the nature of EUT, the applicable Test is Ae: This procedure is applied to specimens heat dissipative which are subjected to low temperature during an enough period for the specimen to reach the thermal stability. The EUT is required to be operating during all test duration.

Test Severities

The specimen is introduced into the chamber which is at the temperature of the laboratory. The temperature is then adjusted to the temperature appropriate to the degree of severity, as specified in the relevant specification. After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration. For specimens that are required to be operational (even though they do not meet the requirements of being heat dissipating), power shall then be applied to the specimen and a functional test is performed as necessary. A further period of stabilization may be necessary and the specimen shall then be exposed to the low temperature conditions for a duration as specified in the relevant specification. Specimens under test are normally in operating conditions.

Test condition:

Test Temperature: -30 º C
Test Duration : 16h

Test result:

Measurements Pre-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.6	Voltage AC (V)	230.0
Current DC (A)	130.6	Current AC (A)	144.2
Power DC (kW)	102.3	Active Power AC (kW)	99.6

Measurements During the test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.6	Voltage AC (V)	230.8
Current DC (A)	130.5	Current AC (A)	144.2
Power DC (kW)	102.3	Active Power AC (kW)	99.6

Measurements Post-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.6	Voltage AC (V)	230.4
Current DC (A)	130.5	Current AC (A)	144.2
Power DC (kW)	102.3	Active Power AC (kW)	99.6

After the test, the EUT can operation normally.

4.2 TEST BE: DRY HEAT

The test purpose is the determination of the aptitude of the components, equipment and other items for use, transport or storage at high temperature, according to the standard IEC 60068-2-2. Environmental testing. Part 2-2: Tests. Test B: Dry heat

Due to the nature of EUT applicable test Be: This procedure is applied to specimens heat dissipative which are subjected to high temperature during an enough period time for the specimen to reach the thermal stability. The EUT is required to be operating during all test duration.

Test Severities

The specimen is introduced into the chamber, which is at the temperature of the laboratory. The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification. After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration. For specimens that are required to be operational (even though they do not meet the requirements of being heat dissipating) power shall then be applied to the specimen and a functional test is performed as necessary. A further period of stabilization may be necessary and the specimen shall then be exposed to the high temperature conditions for a duration as specified in the relevant specification.
Specimens under test are normally in operating conditions.

Test condition:
Test Temperature: +60℃
Test Duration : 16h
Test result:
Measurements Pre-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.3
Power DC (kW)	102.5	Active Power AC (kW)	99.7

Measurements During test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.6	Voltage AC (V)	230.0
Current DC (A)	119.4	Current AC (A)	130.7
Power DC (kW)	93.8	Active Power AC (kW)	90.2

Measurements Post-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.6	Voltage AC (V)	230.0
Current DC (A)	130.6	Current AC (A)	144.2
Power DC (kW)	102.3	Active Power AC (kW)	99.6

After the test, the EUT can operation normally.

4.3 TEST NB: CHANGE OF TEMPERATURE

This test includes alternating periods of high and low temperature with a good definition of transference between both temperatures. The test has been performed according to the standard IEC 60068-2-14. Environmental testing. Part 2-14: Tests. Test N: Change of temperature.

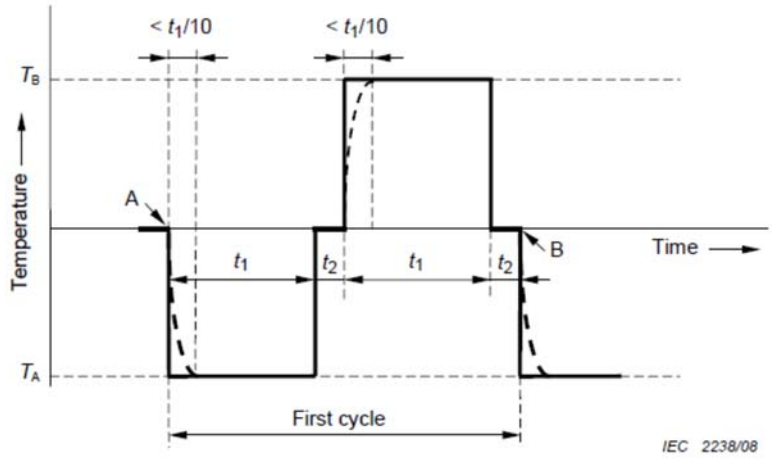
The inverter has been subjected to thermal changes according to the test Nb in order to evaluate the ability of components, equipment or other articles to withstand rapid changes of ambient temperature. With this method, variations of temperature are controlled with a specified speed of change.

The complete test performed includes:

1. Variation from standard atmospheric conditions to the temperature of conditioning “A”.
2. Variation from temperature of conditioning “A” to temperature of conditioning “B”.
3. Variation from temperature of conditioning “B” to temperature of conditioning “A”.
4. Variation from temperature of conditioning “A” to temperature of conditioning “B”.
5. Variation from the temperature of conditioning “B” to the ambient temperature of laboratory.

Test Severities

The severity of the test is defined by the combination of the two temperatures, the transfer time, the exposure time of the specimen and the number of cycles.
The lower temperature, TA, shall be specified in the relevant specification and should be chosen from the test temperatures of IEC 60068-2-1 and IEC 60068-2-2.
The higher temperature, TB, shall be specified in the relevant specification and should be chosen from the test temperatures of IEC 60068-2-1 and IEC 60068-2-2.
The exposure time, t1, of each of the two temperatures depends upon the heat capacity of the specimen. It may be 3 h, 2 h, 1 h, 30 min or 10 min, or as specified in the relevant specification. Where no exposure period is specified in the relevant specification, it is understood to be 3 h.
The preferred number of test cycles is five, unless otherwise specified in the relevant specification.



Key

A start of first cycle
B end of first cycle and start of second cycle

NOTE The dotted curve is explained above.

Figure 2 – Na test cycle

Test condition:
Low temperature T_A: -30℃
High temperature T_B: +60℃
Duration of exposure time t_1: 3h
Duration of transfer time t_2: 3min
Number of cycles: 5
Recovery: 2h

Test result:

Measurements Pre-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.3
Power DC(kW)	102.5	Active Power AC (kW)	99.7

Measurements During test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.4
Power DC (kW)	102.5	Active Power AC (kW)	99.7

Measurements Post-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.4
Power DC (kW)	102.5	Active Power AC (kW)	99.7

After the test, the EUT can operation normally.

4.4 TEST DB: DAMP HEAT, CYCLIC (12 H + 12 H)

The test purpose is the determination of the suitability of components, equipment or other articles for the use, transportation and storage abnormal conditions of high humidity, combined with cyclic temperature changes and, in general, producing condensation on the surface of the specimen, according to the standard IEC 60068-2-30. Environmental testing. Part 2-30: Tests. Test Db-Variant 1: Damp heat, Cyclic (12 h + 12 h).

Test Severities

Variant 2 (see Figure 2b)
The temperature shall be lowered to 25 °C ± 3 K within 3 h to 6 h, but without the additional requirement for the first hour and one half as in variant 1. The relative humidity shall be not less than 80 % RH.

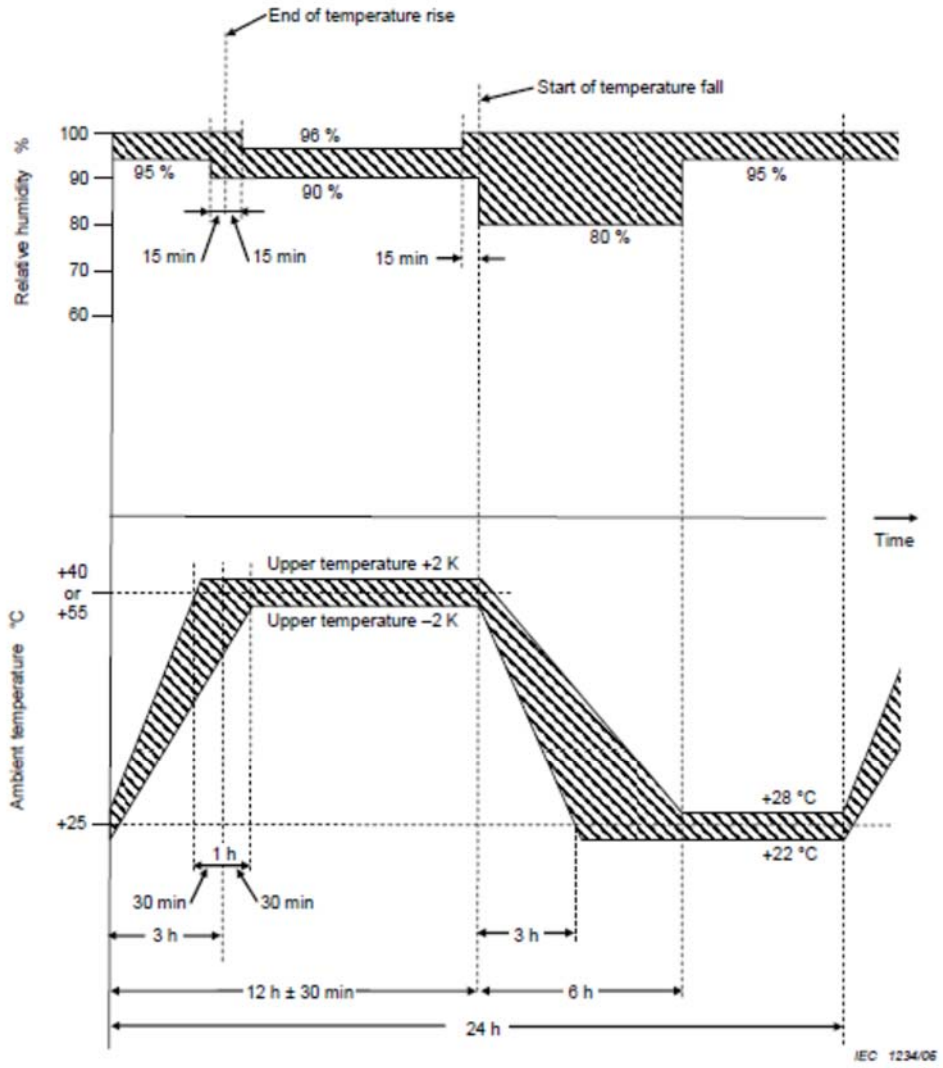


Figure 2b – Test Db – Test cycle – Variant 2

Test condition:

Test Db, variant 2, b-cycle
The humidity level shall be 95 % ± 5 %
A minimum number of 3 cycles
Lower temperature: 25°C
Upper temperature: 55°C

Test result:

Measurements Pre-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.4
Power DC (kW)	102.5	Active Power AC (kW)	99.7

Measurements During test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.4
Power DC (kW)	102.5	Active Power AC (kW)	99.7

Measurements Post-functional test:

PV Input:		AC grid output (line to neutral):	
Voltage DC (V)	785.7	Voltage AC (V)	230.0
Current DC (A)	130.8	Current AC (A)	144.3
Power DC (kW)	102.5	Active Power AC (kW)	99.7

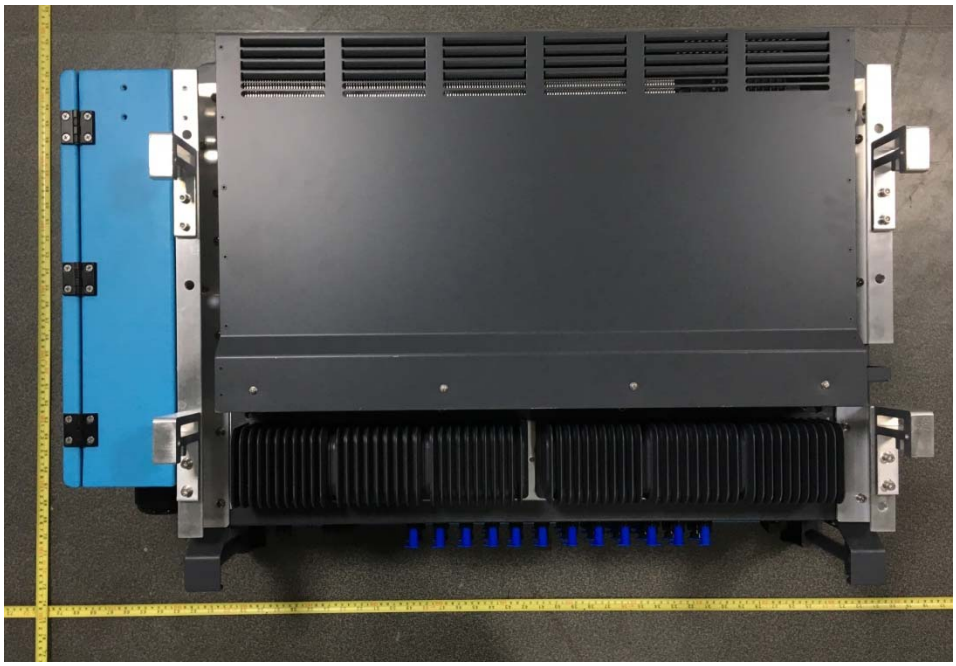
After the test, the EUT can operation normally.

5 PICTURES

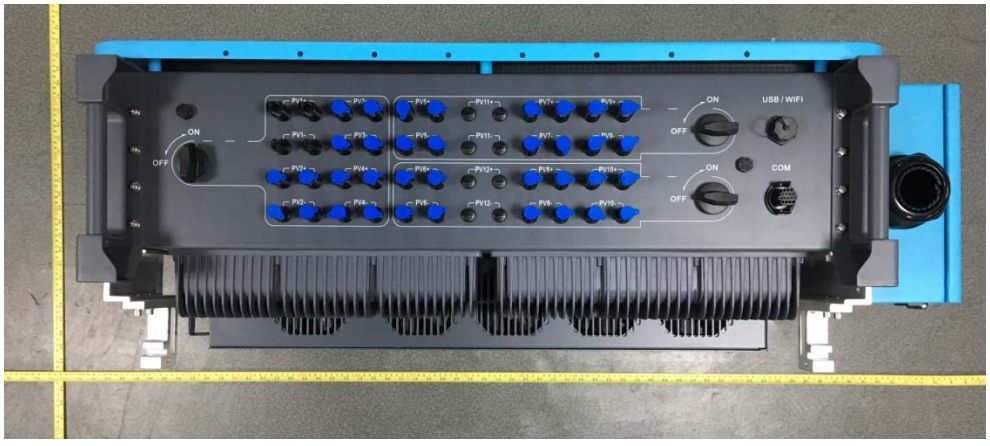
Front view

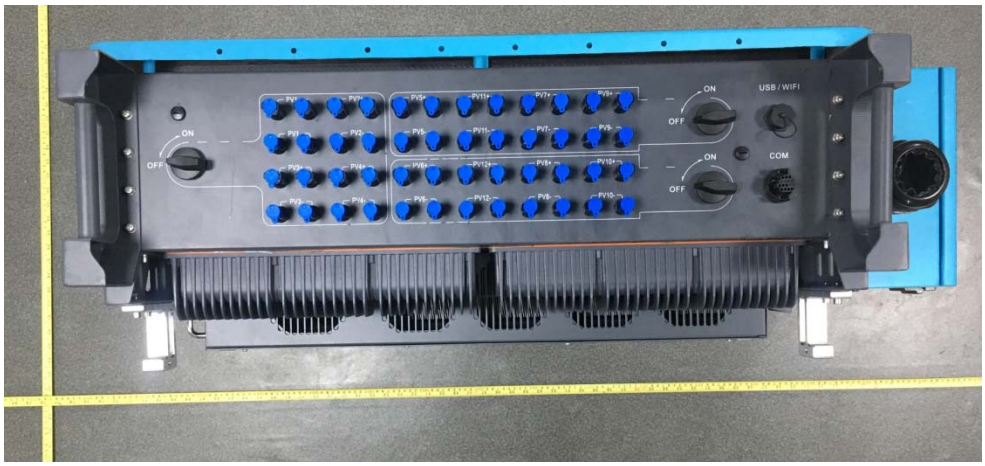
Back view (E-75KTL, E-80KTL)


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

Back view (E- 136KTL-HV)


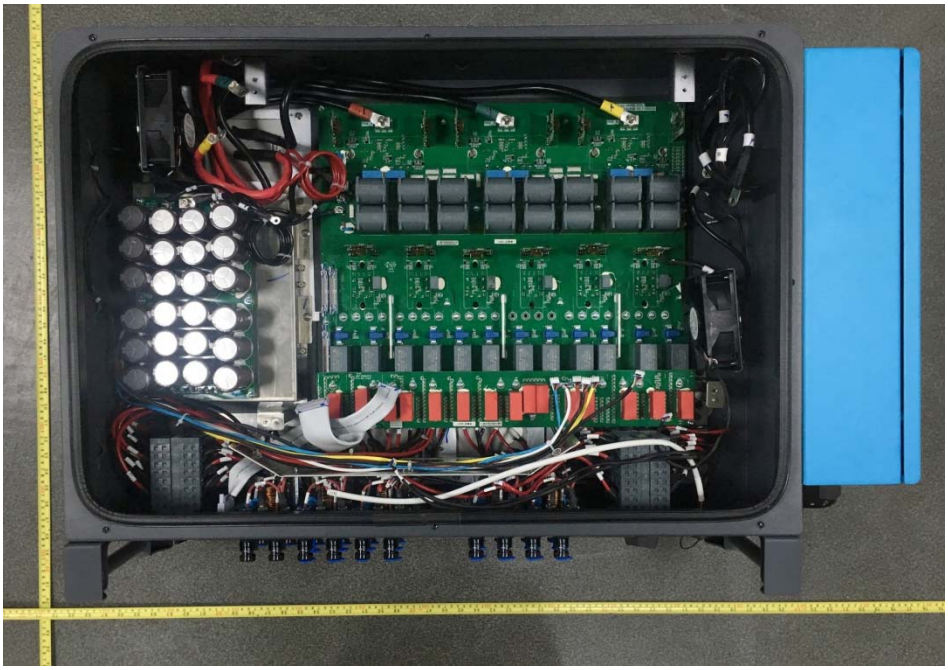
DC Connection interface (E-75KTL, E-80KTL)


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


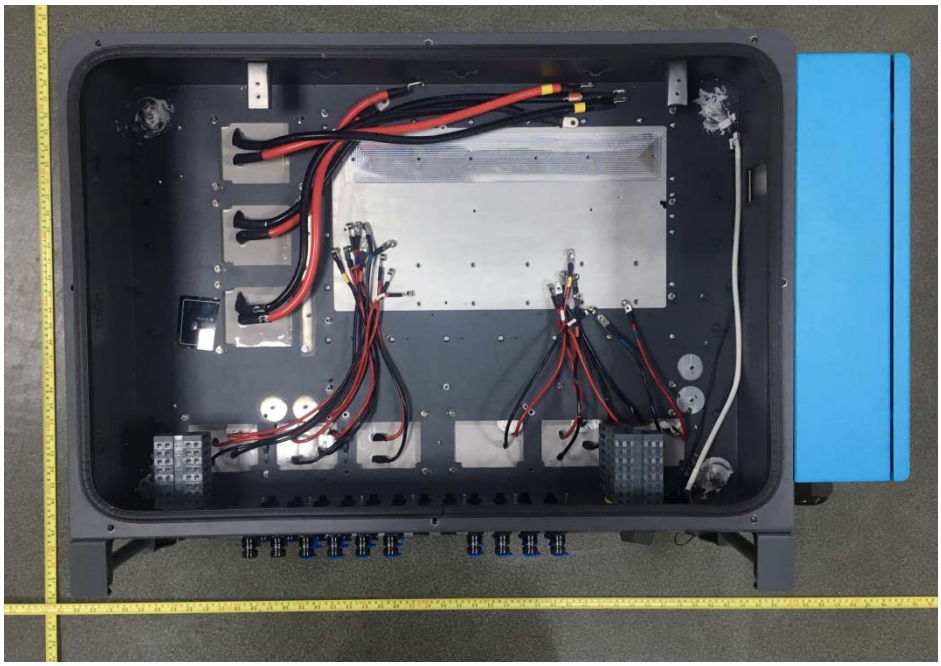
DC Connection interface (E-136KTL-HV)


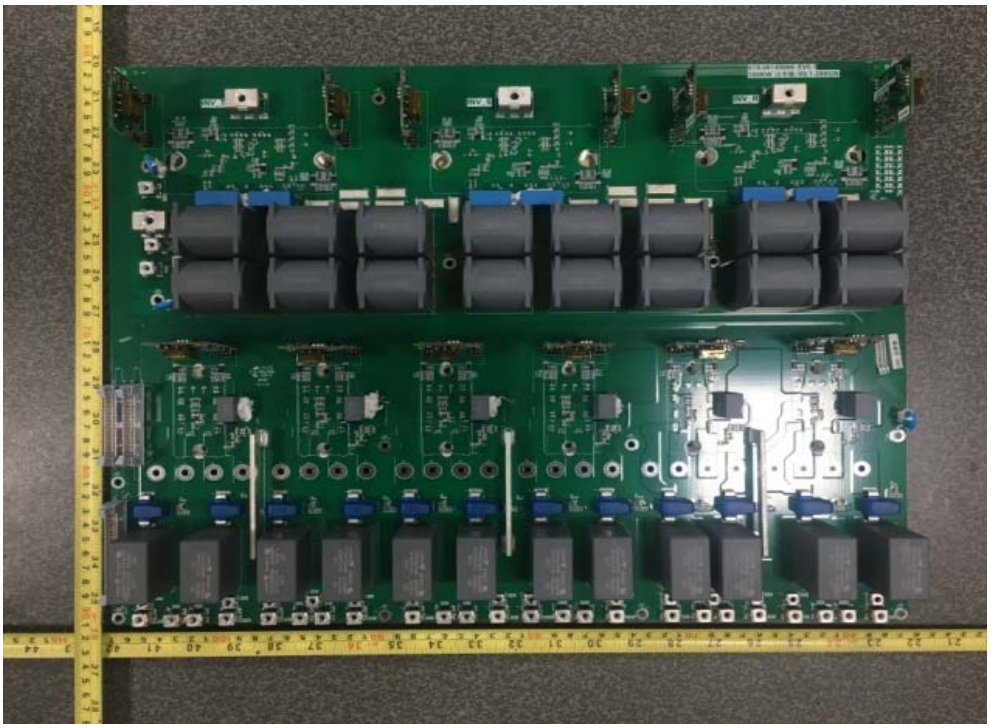
Internal View 1

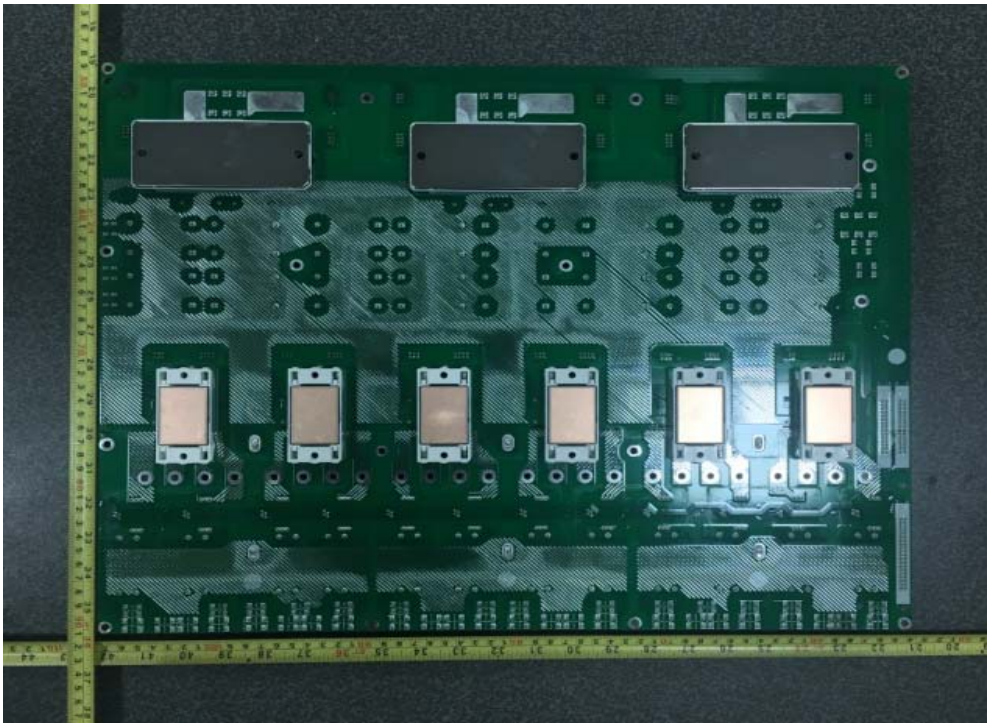

Internal View 2

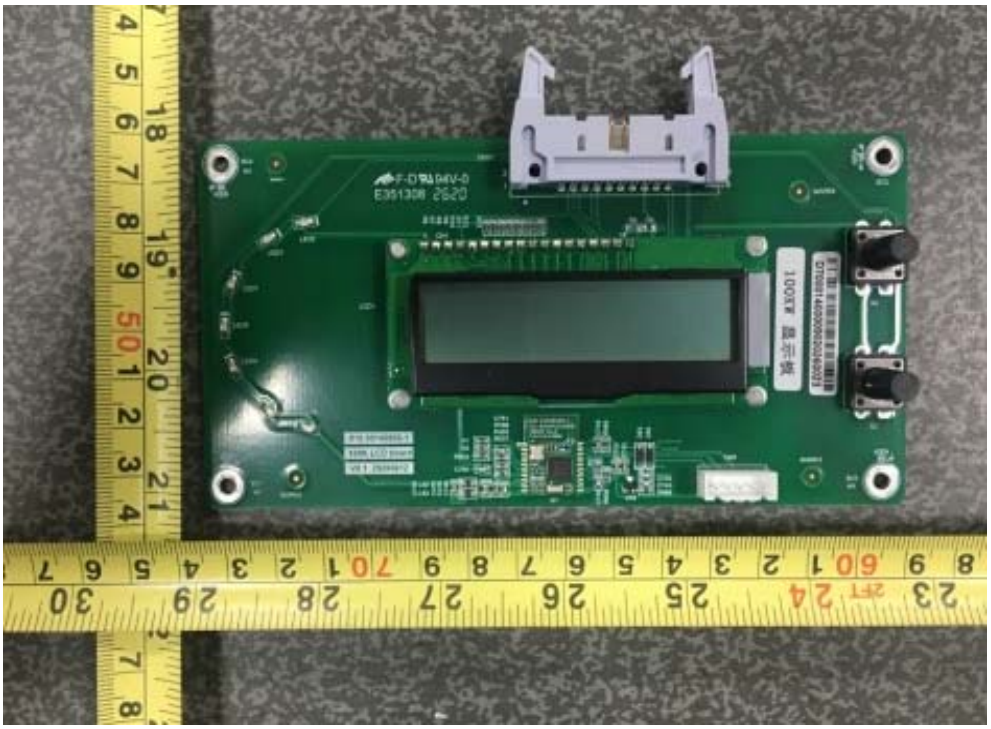
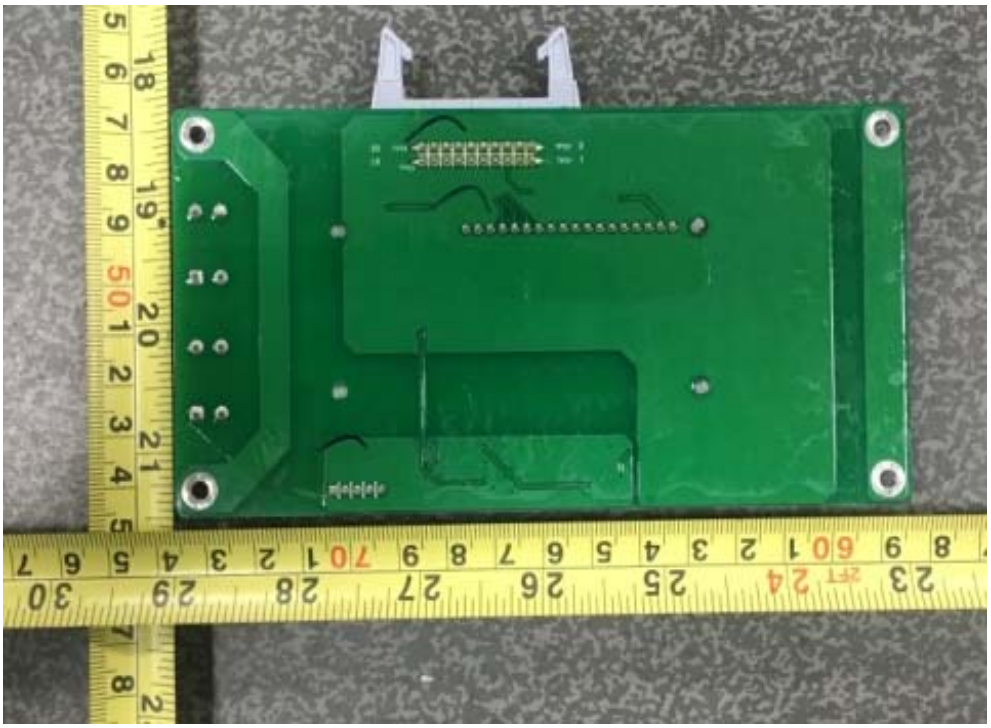


Internal View 3

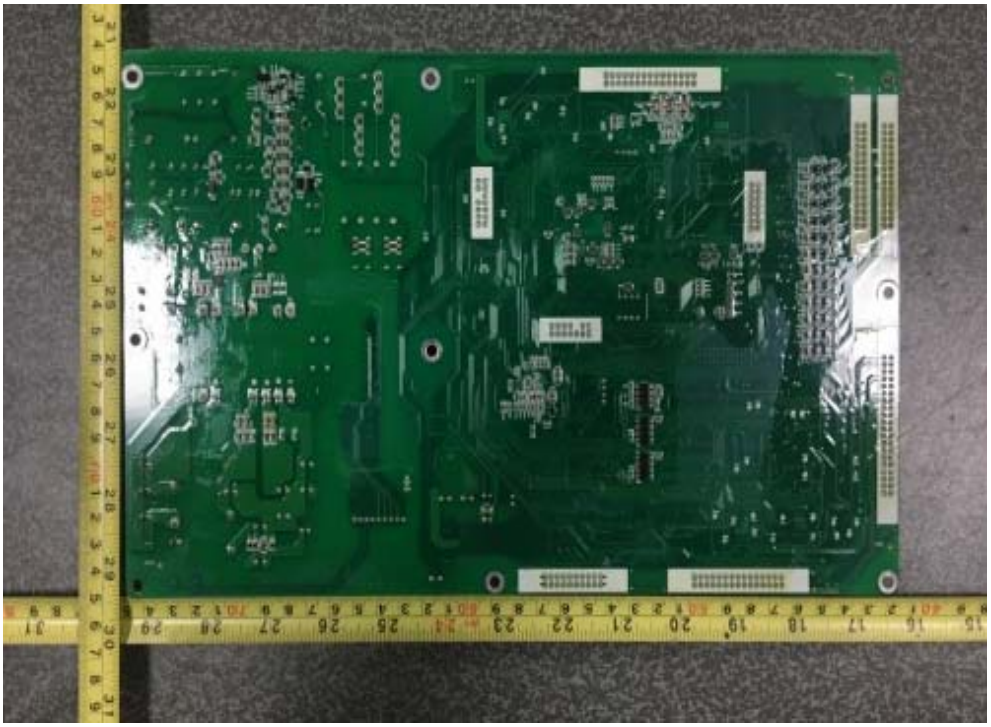


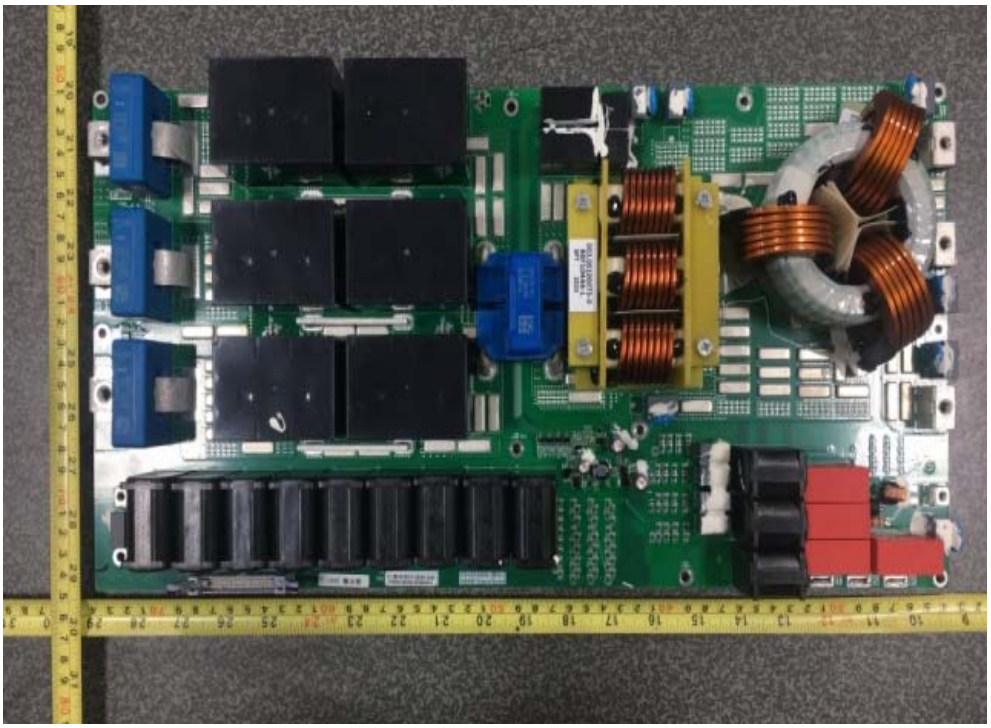
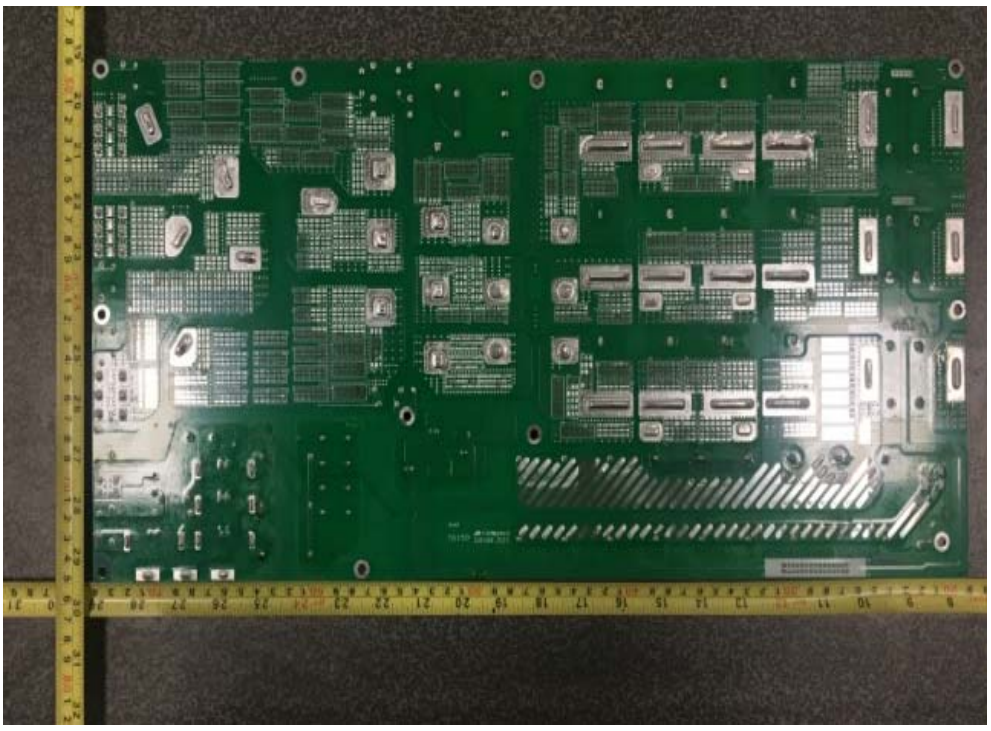
Front side of Power board


Back side of Power board


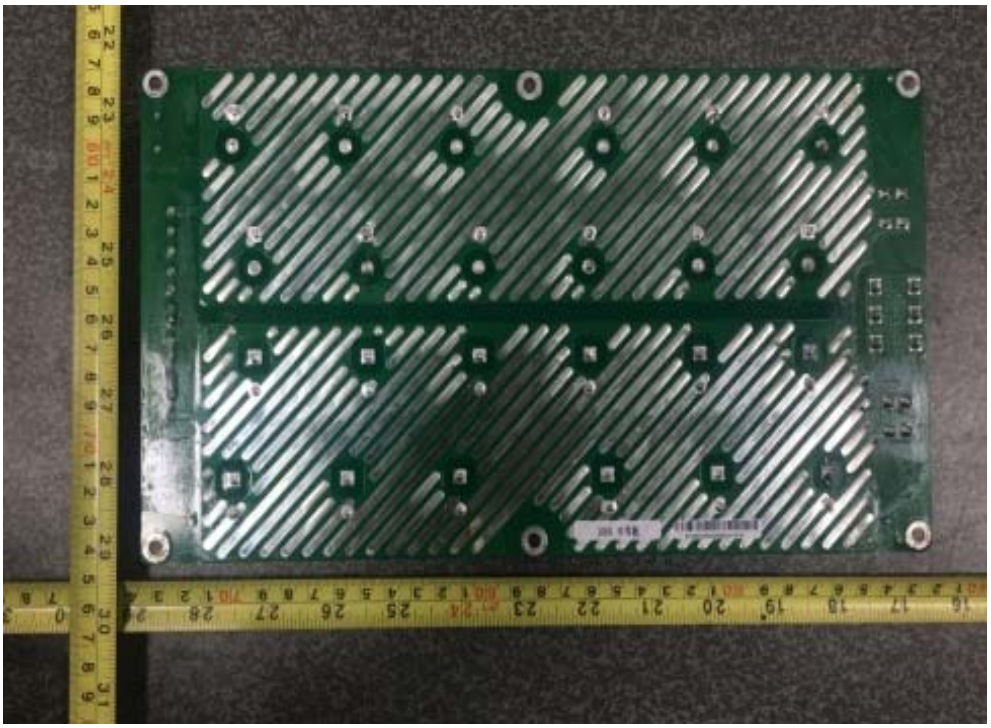
Front side of Display board

Back side of Display board


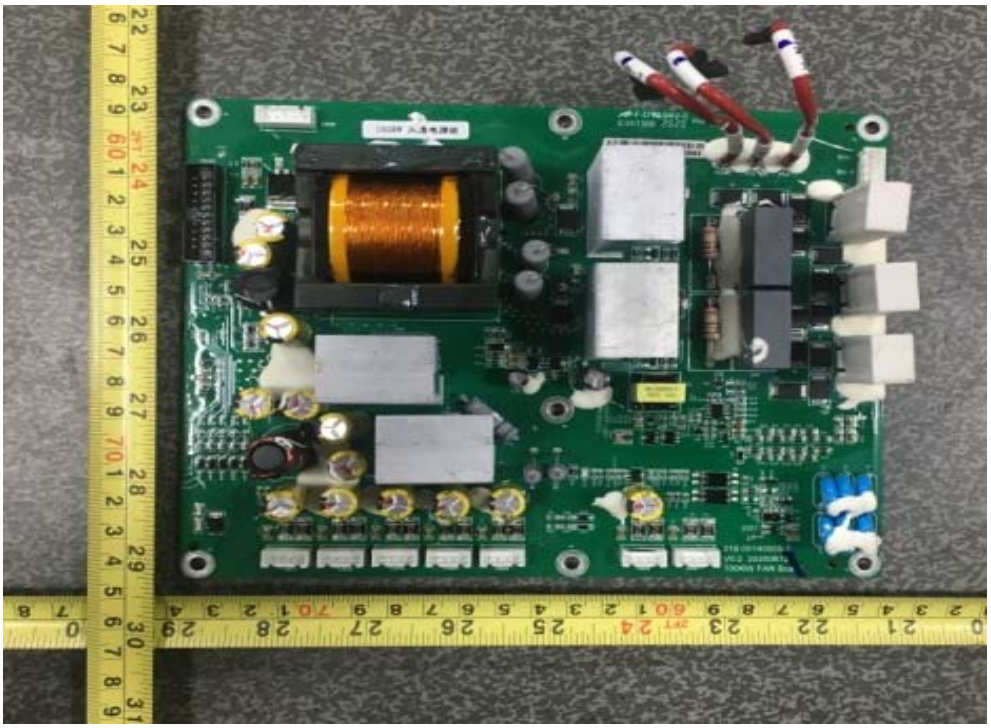
Front side of Control board

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

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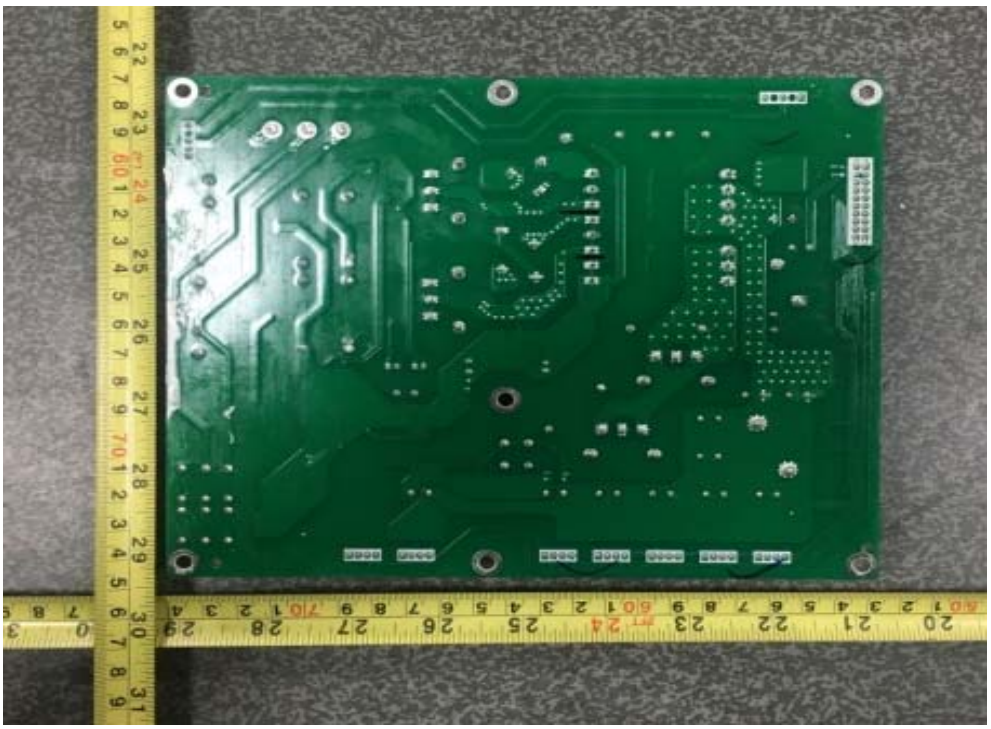
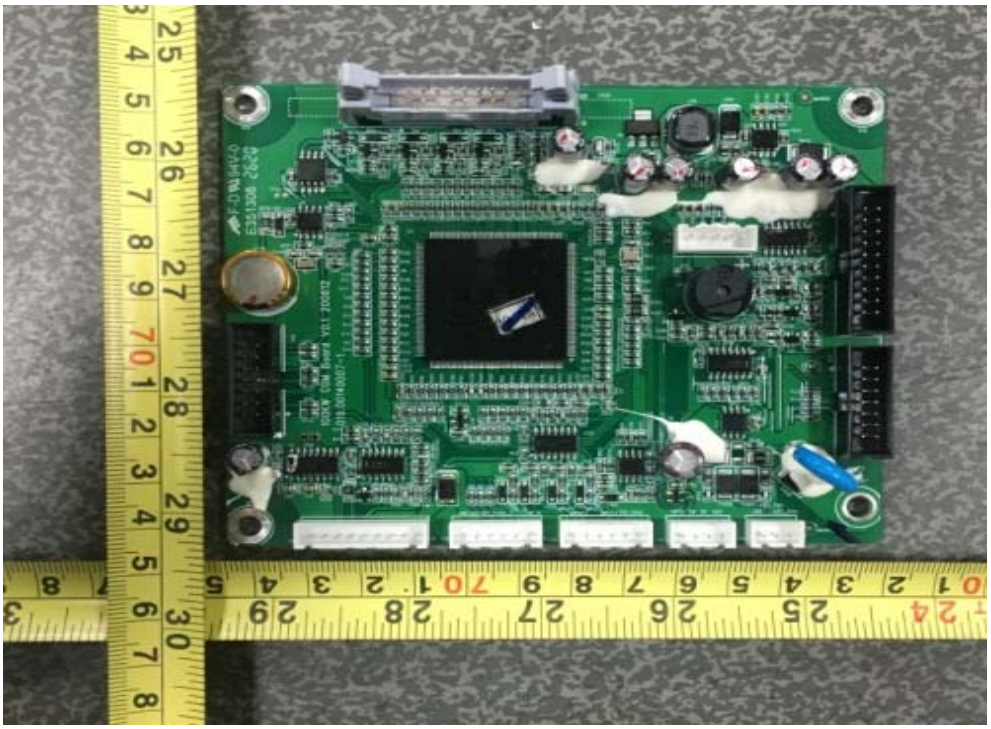


Front side of Communication board


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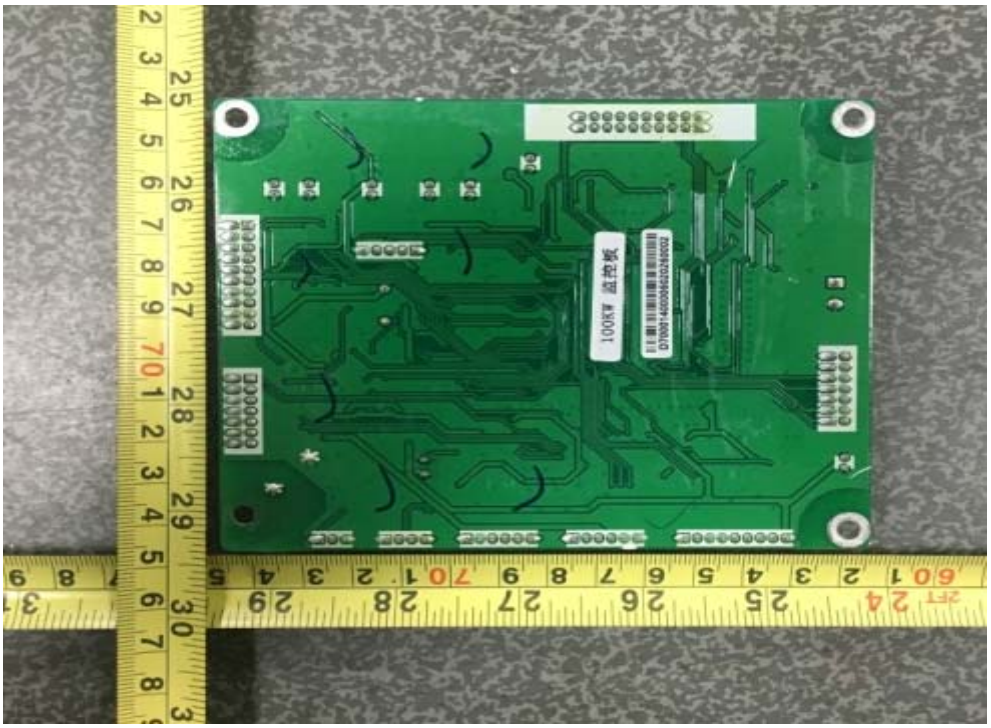

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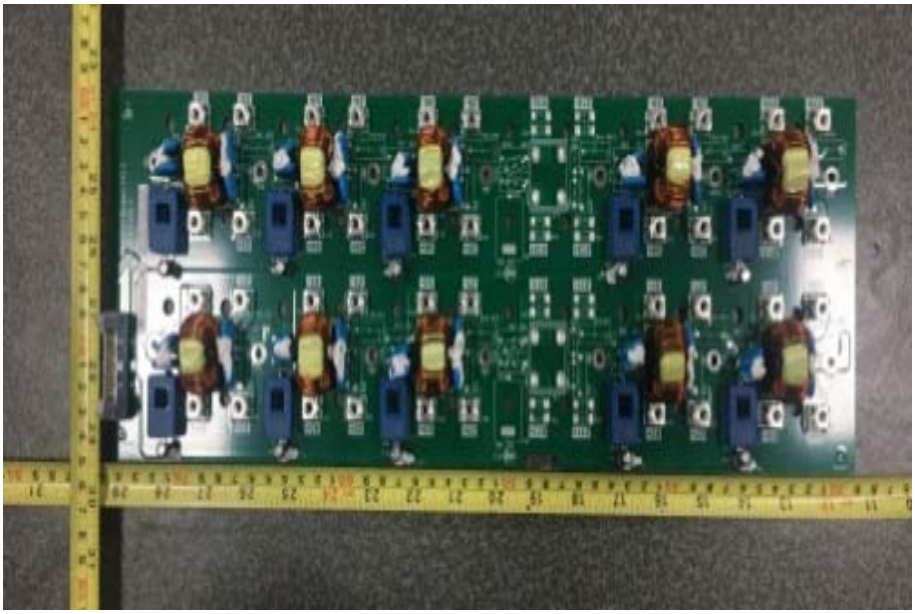
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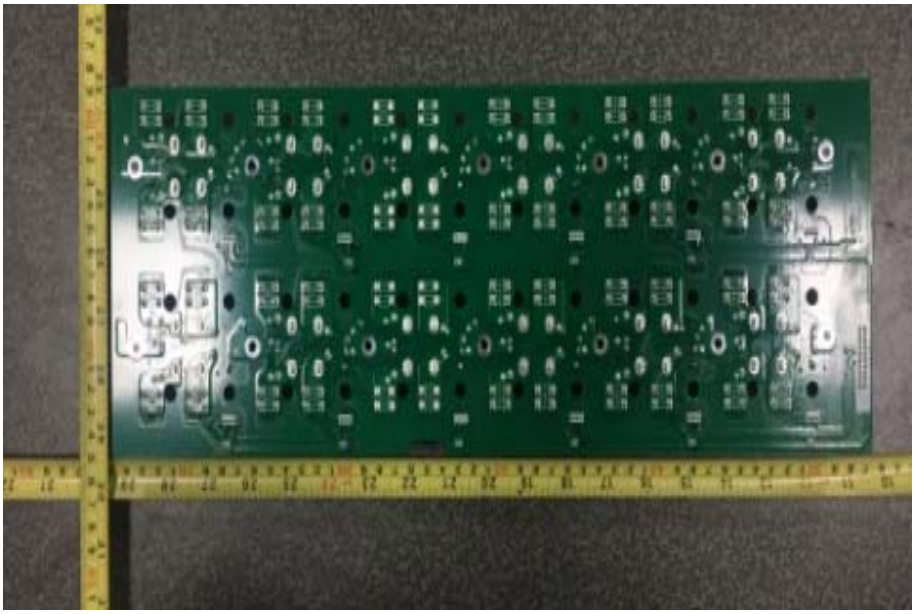

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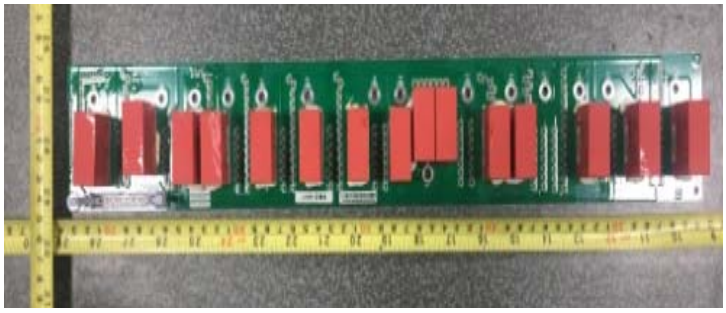

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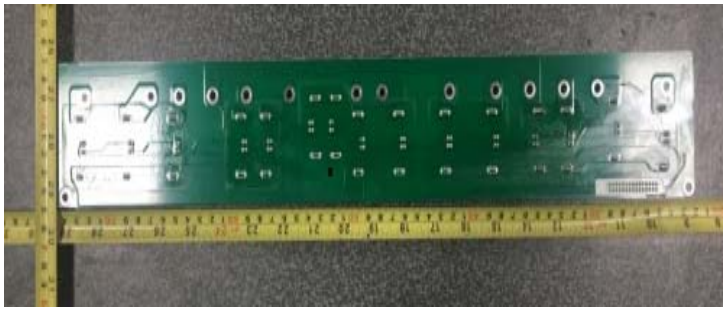
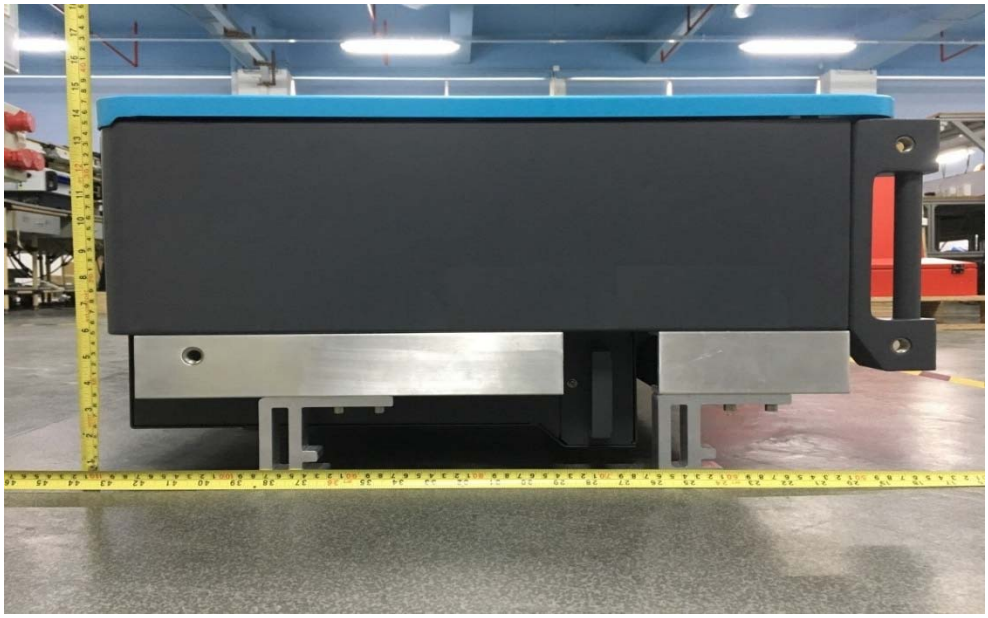
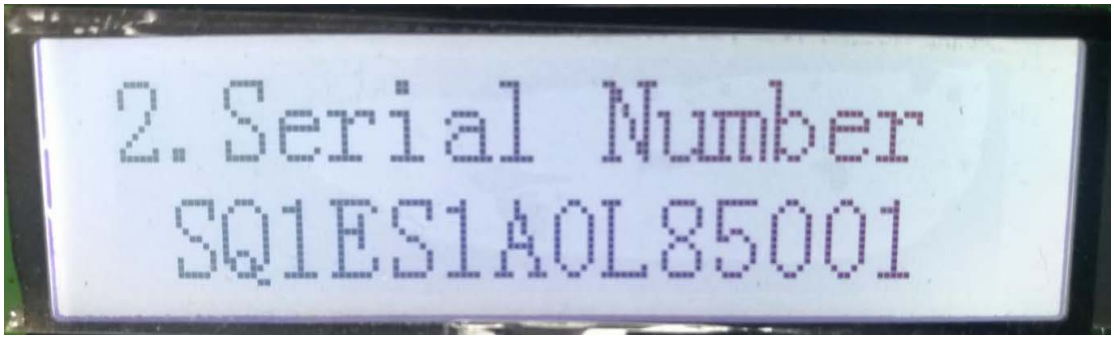
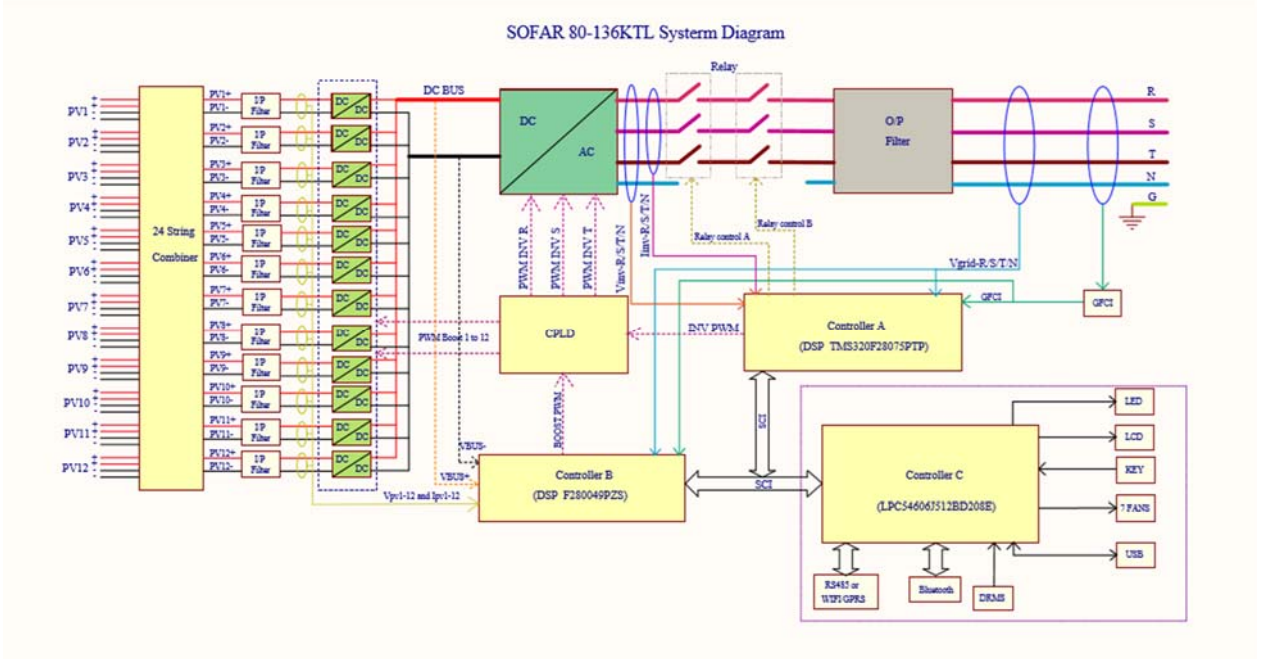


AC Connection interface

Side view


Serial Number

Software Version
      

6 ELECTRICAL SCHEMES



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