TEST REPORT

UNE217002 IN

Requisitos de conexion a la red eléctrica

Ensayos de los requisitos de inyección de corriente continua a la red, generación de sobretensiones y sistema de detección de funcionamiento en isla

Report reference number .....:	**CGPT-ESH-P26061474-2**
Date of issue .....:.....	2026-06-25
Total number of pages .....:.....	56
Testing laboratory name.....:	**Bureau Veritas Consumer Products Services Germany GmbH**
Address .....:	Businesspark A96, 86842 Türkheim, Germany
Accreditation.....:	ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12024-03-00
Applicant's name.....:	**Guangzhou Felicity Solar Technology Co.,Ltd.**
Address .....:	(Airport Baiyun)No.2,4,6,8,10 and 12 Donghua Huaye Road,Renhe Town,Baiyun District,Guangzhou,Guangdong,P.R.China
Test specification	
Standard.....:	UNE 217002:2020 Inversores para conexión a la red de distribución Ensayos de los requisitos de inyección de corriente continua a la red, generación de sobretensiones y sistema de detección de funcionamiento en isla TED/749/2020; RD 647/2020
Certificate.....:	**Certificate of compliance**
Test report form number.....:	UNE 217002
Master TRF .....:	Bureau Veritas Consumer Products Services Germany GmbH
Test item description .....:	**Hybrid Inverter**
Trademark .....:	felicitysolar® Make life full of hope
Model / Type.....:	IVGM3KLP1G2-24, IVGM3KLP1G2, IVGM3K6LP1G2, IVGM4K6LP1G2, IVGM5KLP1G2, IVGM6KLP1G2

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Characteristics of inverter and storage system (Hybrid-System)			
Inverter model	IVGM3KLP1G2-24	IVGM3KLP1G2	IVGM3K6LP1G2
Input (PV DC)			
Max. Input Voltage [V]	500		
MPPT Voltage Range [V]	150-425		
Max. Input Current [A]	18	18	18/18
Max. Short Current [A]	27	27	27/27
Input (battery DC)			
DC Voltage Range [V]	20-30	40-60	40-60
Max. DC Voltage [V]	30	60	60
Max. Charge/Discharge Current [A]	140/140	70/70	90/90
AC Input and Output (On-grid)			
Rated Output AC Voltage [V]	L/N/PE, 230V, 50/60Hz		
Rated Output Current [A]	13,1	13,1	16,0
Max. Output Current [A]	14,4	14,4	16,0
Rated Output Power [W]	3000	3000	3680
Max. Apparent Output Power [VA]	3300	3300	3680
AC Output (Backup)			
Rated Output AC Voltage [V]	L/N/PE, 230V, 50/60Hz		
Rated Output Current [A]	13,1	13,1	16,0
Max. Output Current [A]	14,4	14,4	16,0
Rated Output Power [W]	3000	3000	3680
Max. Apparent Output Power [VA]	3300	3300	3680
Note: All test in 230V/50Hz Batteries are not integrated in the inverter and must be installed according to local regulations.			

Characteristics of inverter and storage system (Hybrid-System)			
Inverter model	IVGM4K6LP1G2	IVGM5KLP1G2	IVGM6KLP1G2
Input (PV DC)			
Max. Input Voltage [V]	500		
MPPT Voltage Range [V]	150-425		
Max. Input Current [A]	18/18	18/18	18/18
Max. Short Current [A]	27/27	27/27	27/27
Input (battery DC)			
DC Voltage Range [V]	40-60	40-60	40-60
Max. DC Voltage [V]	60	60	60
Max. Charge/Discharge Current [A]	115/115	120/120	135/135
AC Input and Output (On-grid)			
Rated Output AC Voltage [V]	L/N/PE, 230V, 50/60Hz		
Rated Output Current [A]	20	21,8	26,1
Max. Output Current [A]	22	24	28,7
Rated Output Power [W]	4600	5000	6000
Max. Apparent Output Power [VA]	5060	5500	6600
AC Output (Backup)			
Rated Output AC Voltage [V]	L/N/PE, 230V, 50/60Hz		
Rated Output Current [A]	20	21,8	26,1
Max. Output Current [A]	22	24	28,7
Rated Output Power [W]	4600	5000	6000
Max. Apparent Output Power [VA]	5060	5500	6600
Note: All test in 230V/50Hz Batteries are not integrated in the inverter and must be installed according to local regulations.			

Testing Location.....:	**LCIE China Company Limited**
Address .....:	Building 4, No. 518, Xinzhuan Road, Caohejing, Songjiang High-Tech Park, Shanghai, P,R, China (201612)
Tested by (name and signature) .....:	Joell Qin
Approved by (name and signature) .....:	Robin Wu
Manufacturer's name .....:	**Guangzhou Felicity Solar Technology Co.,Ltd.**
Manufacturer address .....:	(Airport Baiyun)No.2,4,6,8,10 and 12 Donghua Huaye Road,Renhe Town,Baiyun District,Guangzhou,Guangdong,P.R.China
Factory's name .....:	**Guangzhou Felicity Solar Technology Co.,Ltd.**
Factory address.....:	(Airport Baiyun)No.2,4,6,8,10 and 12 Donghua Huaye Road,Renhe Town,Baiyun District,Guangzhou,Guangdong,P.R.China

Joell Qin
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Document History

Date	Internal reference	Modification / Change / Status	Revision
2026-06-25	Joell Qin	Initial report was written	0

Supplementary information:

Test items particulars

Equipment mobility ..... :	Permanent connection
Operating condition ..... :	Continuous
Class of equipment..... :	Class I
Protection against ingress of water .. :	IP65 according to EN 60529
Mass of equipment [kg] ..... :	19,8 kg for all models

Test case verdicts

Test case does not apply to the test object ..... :	N/A
Test item does meet the requirement ..... :	P(ass)
Test item does not meet the requirement ..... :	F(ail)

Testing

Date of receipt of test item ..... :	2026-03-14
Date(s) of performance test..... :	2026-03-15 to 2026-05-03

General remarks:

The test result presented in this report relate only to the object(s) tested,
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”(see Annex #)" refers to additional information appended to the report,
"(see appended table)" refers to a table appended to the report,
Throughout this report a comma is used as the decimal separator,

The IEC61727 does not provide any limits of accuracy for the utility voltage and frequency measurement of the PV-system, If nothing different stated at the test table the values for tolerances given in EN 50438, Table 2 are used,

Tolerances on trip values tabel 2 EN50438:

- Voltage: +/- 1% of the nominal voltage
- Frequency: +/- 0,5% of the nominal frequency
- Clearance time: +/- 10%

This Test Report consists of the following documents:

1. Test Results
2. Annex No. 1 – Datasheet of the relay
3. Annex No. 2 – Pictures of the unit
4. Annex No. 3 – Test equipment list

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

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IVGM3KLP1G2-24

Product Type	Hybrid Inverter
Overvoltage-category	DC II ; AC III
Ambient Temperture	-25°C~60°C,>45°C Derating
Battery	
Battery Voltage Range	20Vd.c.-30Vd.c.
Max. Charging and Discharging Current	140Ad.c./140Ad.c.
Max. Charging and Discharging Power	3000W
PV	
Max.PV Input Voltage	500Vd.c.
Min.PV Input Voltage	90Vd.c.
MPPT Input Range	150Vd.c.-425Vd.c.
Max. Input Current	18Ad.c.
Max. Shorted Current	27Ad.c.
Max. PV Input Power	4800W
On-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	13.7Aa.c./13.1Aa.c.
Max. Continuous AC Passthrough	35Aa.c.
AC Output Rated Active Power	3000W
Max.AC Output Apparent Power	3300VA
AC Output Power Factor	0.8 Leading To 0.8 Lagging
Off-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	13.7Aa.c./13.1Aa.c.
Max. AC Output Current	15Aa.c./14.4Aa.c.
AC Output Rated Active Power	3000W
Max.AC Output Apparent Power	3300VA
Non-isolated topology, IP65,Class I protective class	

RoHS

CAUTION:
- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy. Do not touch while working!

Manufacturer:
Guangzhou Felicity Solar Technology Co., Ltd.
Address:
(Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road,
Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China

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IVGM3KLP1G2

Product Type	Hybrid Inverter
Overvoltage-category	DC II ; AC III
Ambient Temperture	-25°C~60°C,>45°C Derating
Battery	
Battery Voltage Range	40Vd.c.~60Vd.c.
Max. Charging and Discharging Current	70Ad.c./70Ad.c.
Max. Charging and Discharging Power	3000W
PV	
Max.PV Input Voltage	500Vd.c.
Min.PV Input Voltage	90Vd.c.
MPPT Input Range	150Vd.c.-425Vd.c.
Max. Input Current	18Ad.c.
Max. Shorted Current	27Ad.c.
Max. PV Input Power	4800W
On-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	13.7Aa.c./13.1Aa.c.
Max. Continuous AC Passthrough	35Aa.c.
AC Output Rated Active Power	3000W
Max.AC Output Apparent Power	3300VA
AC Output Power Factor	0.8 Leading To 0.8 Lagging
Off-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	13.7Aa.c./13.1Aa.c.
Max. AC Output Current	15Aa.c./14.4Aa.c.
AC Output Rated Active Power	3000W
Max.AC Output Apparent Power	3300VA
Non-isolated topology, IP65,Class I protective class	

RoHS

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IVGM3K6LP1G2

Product Type	Hybrid Inverter
Overvoltage-category	DC II ; AC III
Ambient Temperture	-25°C~60°C,>45°C Derating
Battery	
Battery Voltage Range	40Vd.c.~60Vd.c.
Max. Charging and Discharging Current	90Ad.c./90Ad.c.
Max. Charging and Discharging Power	3600W
PV	
Max.PV Input Voltage	500Vd.c.
Min.PV Input Voltage	90Vd.c.
MPPT Input Range	150Vd.c.-425Vd.c.
Max. Input Current	18Ad.c./18Ad.c.
Max. Shorted Current	27Ad.c./27Ad.c.
Max. PV Input Power	5760W
On-Grid Mode	
AC Output Voltage	230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	16Aa.c.
Max. Continuous AC Passthrough	35Aa.c.
AC Output Rated Active Power	3680W
Max.AC Output Apparent Power	3680VA
AC Output Power Factor	0.8 Leading To 0.8 Lagging
Off-Grid Mode	
AC Output Voltage	230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	16Aa.c.
Max. AC Output Current	16Aa.c.
AC Output Rated Active Power	3680W
Max.AC Output Apparent Power	3680VA
Non-isolated topology, IP65,Class I protective class	

CAUTION:
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IVGM4K6LP1G2

Product Type	Hybrid Inverter
Overvoltage-category	DC II ; AC III
Ambient Temperture	-25°C~60°C,>45°C Derating
Battery	
Battery Voltage Range	40Vd.c.~60Vd.c.
Max. Charging and Discharging Current	115Ad.c./115Ad.c.
Max. Charging and Discharging Power	4600W
PV	
Max.PV Input Voltage	500Vd.c.
Min.PV Input Voltage	90Vd.c.
MPPT Input Range	150Vd.c.-425Vd.c.
Max. Input Current	18Ad.c./18Ad.c.
Max. Shorted Current	27Ad.c./27Ad.c.
Max. PV Input Power	7360W
On-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	20.9Aa.c./20Aa.c.
Max. Continuous AC Passthrough	35Aa.c.
AC Output Rated Active Power	4600W
Max.AC Output Apparent Power	5060VA
AC Output Power Factor	0.8 Leading To 0.8 Lagging
Off-Grid Mode	
AC Output Voltage	220Va.c /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	20.9Aa.c./20Aa.c.
Max. AC Output Current	23Aa.c./22Aa.c.
AC Output Rated Active Power	4600W
Max.AC Output Apparent Power	5060VA
Non-isolated topology, IP65,Class I protective class	

CAUTION:
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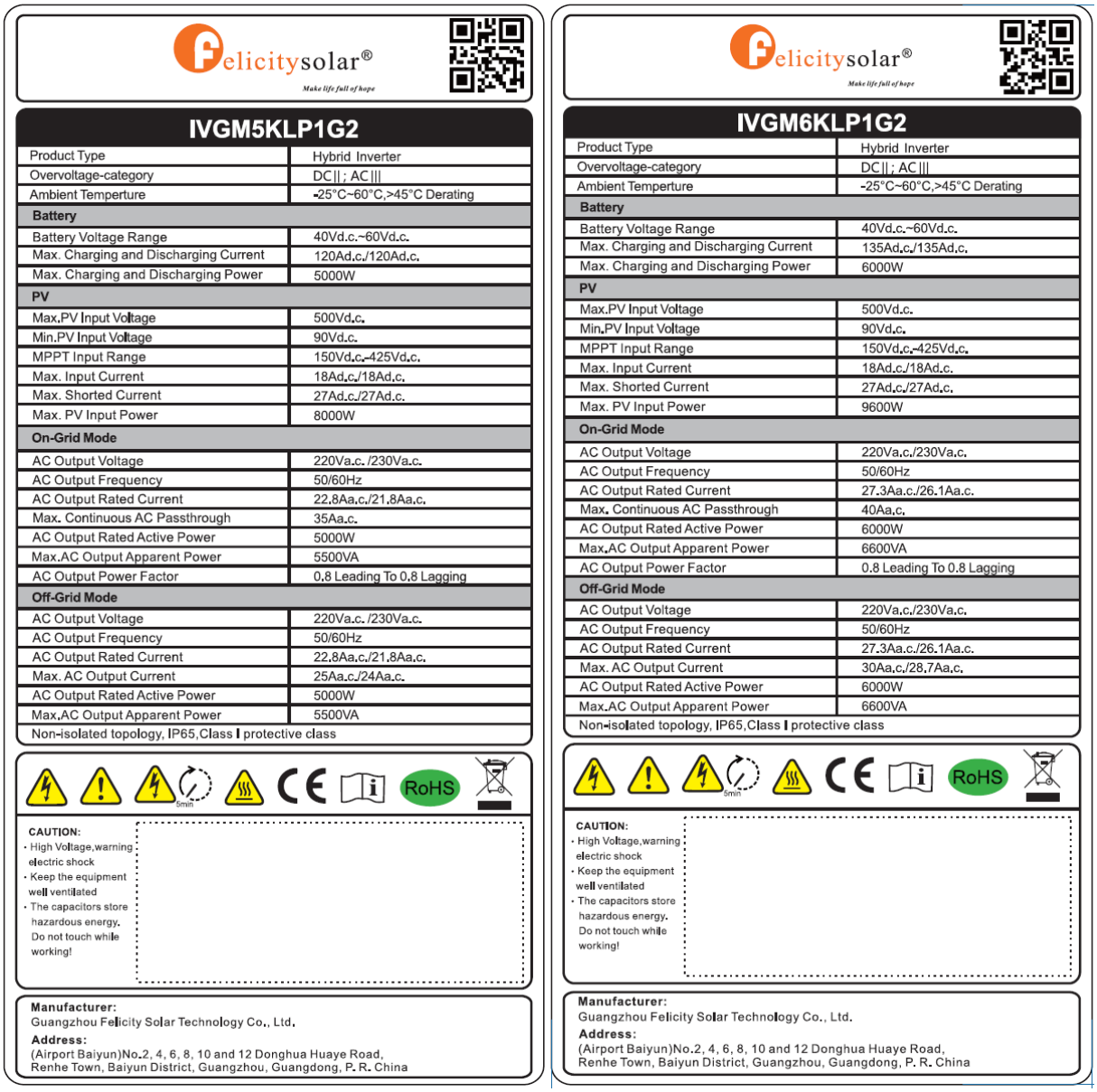

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IVGM5KLP1G2

Product Type	Hybrid Inverter
Overvoltage-category	DC II ; AC III
Ambient Temperture	-25°C~60°C,>45°C Derating
Battery	
Battery Voltage Range	40Vd.c.~60Vd.c.
Max. Charging and Discharging Current	120Ad.c./120Ad.c.
Max. Charging and Discharging Power	5000W
PV	
Max.PV Input Voltage	500Vd.c.
Min.PV Input Voltage	90Vd.c.
MPPT Input Range	150Vd.c.-425Vd.c.
Max. Input Current	18Ad.c./18Ad.c.
Max. Shorted Current	27Ad.c./27Ad.c.
Max. PV Input Power	8000W
On-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	22.8Aa.c./21.8Aa.c.
Max. Continuous AC Passthrough	35Aa.c.
AC Output Rated Active Power	5000W
Max.AC Output Apparent Power	5500VA
AC Output Power Factor	0.8 Leading To 0.8 Lagging
Off-Grid Mode	
AC Output Voltage	220Va.c. /230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	22.8Aa.c./21.8Aa.c.
Max. AC Output Current	25Aa.c./24Aa.c.
AC Output Rated Active Power	5000W
Max.AC Output Apparent Power	5500VA
Non-isolated topology, IP65,Class I protective class	

RoHS

CAUTION:
- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy. Do not touch while working!

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Guangzhou Felicity Solar Technology Co., Ltd.
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(Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road,
Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China

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IVGM6KLP1G2

Product Type	Hybrid Inverter
Overvoltage-category	DC II ; AC III
Ambient Temperture	-25°C~60°C,>45°C Derating
Battery	
Battery Voltage Range	40Vd.c.~60Vd.c.
Max. Charging and Discharging Current	135Ad.c./135Ad.c.
Max. Charging and Discharging Power	6000W
PV	
Max.PV Input Voltage	500Vd.c.
Min.PV Input Voltage	90Vd.c.
MPPT Input Range	150Vd.c.-425Vd.c.
Max. Input Current	18Ad.c./18Ad.c.
Max. Shorted Current	27Ad.c./27Ad.c.
Max. PV Input Power	9600W
On-Grid Mode	
AC Output Voltage	220Va.c./230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	27.3Aa.c./26.1Aa.c.
Max. Continuous AC Passthrough	40Aa.c.
AC Output Rated Active Power	6000W
Max.AC Output Apparent Power	6600VA
AC Output Power Factor	0.8 Leading To 0.8 Lagging
Off-Grid Mode	
AC Output Voltage	220Va.c./230Va.c.
AC Output Frequency	50/60Hz
AC Output Rated Current	27.3Aa.c./26.1Aa.c.
Max. AC Output Current	30Aa.c./28.7Aa.c.
AC Output Rated Active Power	6000W
Max.AC Output Apparent Power	6600VA
Non-isolated topology, IP65,Class I protective class	

RoHS

CAUTION:
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Address:
(Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road,
Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China

Note:

Example of marking plate

General product information:

Hybrid inverter

358-010581-00

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USER GUIDE

IVGM3KLP1G2-24

IVGM3KLP1G2

IVGM3K6LP1G2

IVGM4K6LP1G2

IVGM5KLP1G2

IVGM6KLP1G2



General product information:

Hybrid inverter

Appendix I

Model	IVGM3K LP1G2-24	IVGM3K LP1G2	IVGM3K6 LP1G2	IVGM4K 6LP1G2	IVGM5K LP1G2	IVGM6K LP1G2
Battery Input Data						
Battery Type	Lead-acid or Lithium-ion					
Battery Voltage Range(V)	20-30	40-60				
Max.Charging Current(A)	140	70	90	115	120	135
Max.Discharging Current(A)	140	70	90	115	120	135
Charging Strategy for Li-ion Battery	Self-adaption to BMS					
Number of battery input	1					
PV String Input Data						
Max. PV Access Power(W)	6000	6000	7200	9200	10000	12000
Max PV Input Power(W)	4800	4800	5760	7360	8000	9600
Max PV Input Voltage(V)	500					
Start-up Voltage(V)	125					
MPPT Voltage Range(V)	150-425					
Rated PV Input Voltage(V)	370					
Max Input Short-Circuit Current(A)	27		27+27			
Max Operating PV Input Current(A)	18		18+18			
No.of MPP Trackers/No.of String Per MPP Tracker	1/1		2/1+1			
Grid Data						
Rated AC Input/Output Active Power(W)	3000		3680	4600	5000	6000
Rated AC Input/Output Apparent Power(VA)	3000		3680	4600	5000	6000
Max AC Input/Output Apparent Power(VA)	3300		3680	5060	5500	6600
Peak Power (off-grid)(W)	2 times of rated power,10s					
Rated AC Input/Output Current(A)	13.7/13.1		16	20.9/20	22.8/21.8	27.3/26.1
Max AC Input/Output Current(A)	15/14.4		16	23/22	25/24	30/28.7
Max Continuous AC Passthrough (grid to load)(A)	35					40
Rated Input/Output Voltage/Range(V)	220V/230 0.85Un-1.1Un					
Grid Connection Form	L+N+PE					
Rated Input/Output Grid Frequency/Range	50Hz/45Hz-55Hz 60Hz/55Hz-65Hz					
Power Factor Adjustment Range	0.8 leading to 0.8lagging					
Total Current Harmonic Distortion THDi	<3% (of nominal power)					
DC Injection Current	<0.5%In					

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Hybrid inverter

Efficiency	
Max. efficiency	97.6%
Euro efficiency	96.5%
MPPT efficiency	>99%
Equipment Protection	
DC Reverse Polarity Protection	Integrated
AC Output Overcurrent Protection	Integrated
Thermal Protection	Integrated
AC Output Overvoltage Protection	Integrated
AC Output Short Circuit Protection	Integrated
DC Component Monitoring	Integrated
Arc Fault Circuit Interrupter (optional)	Integrated
Anti-islanding Protection	Integrated
DC Switch	Integrated
Insulation Impedance Detection	Integrated
Residual Current Detection	Integrated
Surge Protection Level	TYPE II(DC),TYPE II(AC)
Interface	
Communication Interface	RS485/RS232/CAN
Monitor Mode	WIFI/Bluetooth
General Data	
Operating Temperature Range	-40 to+60℃,>45℃ Derating
Permissible Ambient Humidity	0~100%
Permissible Altitude	2000m
Noise	<30dB
Ingress Protection(IP) Rating	IP65
Inverter Topology	Non-Isolated
Over Voltage Category	OVC II(DC),OVC III(AC)
Net welght[kg]	19.8
Gross Weight[kg]	24.5
Product Dimension[mm]	470x376x231
Package Dimension[mm]	593x454x348
Warranty[1]	5 Years/10 Years the Warranty Period Depends the Final Installation Site of Inverter, More Info Please Refer to Warranty Policy
Type Of Cooling	natural cooling
Grid Regulation	IEC 61727,IEC 62116,CEI 0-21,EN 50549，NRS 097,RD 140, UNE 217002,OVE-Richtlinie R25,G98,G99,VDE-AR-N 4105
Safety EMC/Standard	IEC/EN 61000-6-1/2/3/4, IEC/EN 62109-1, IEC/EN 62109-2

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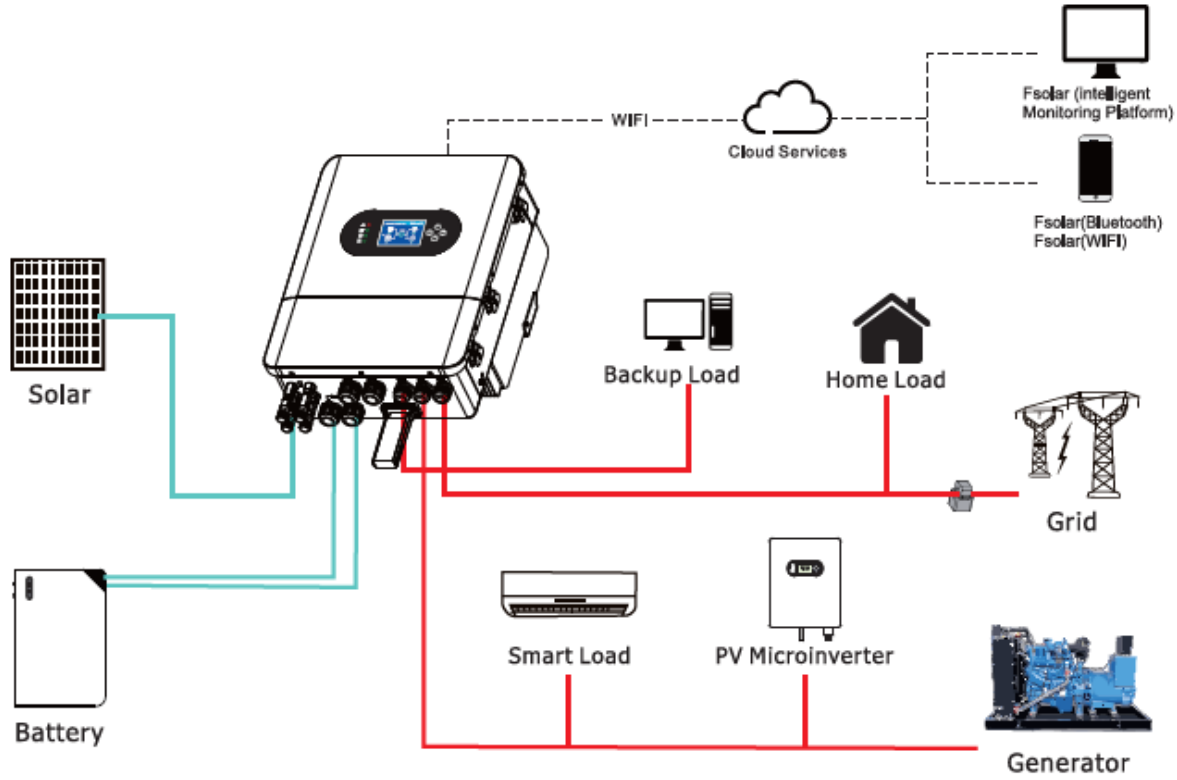
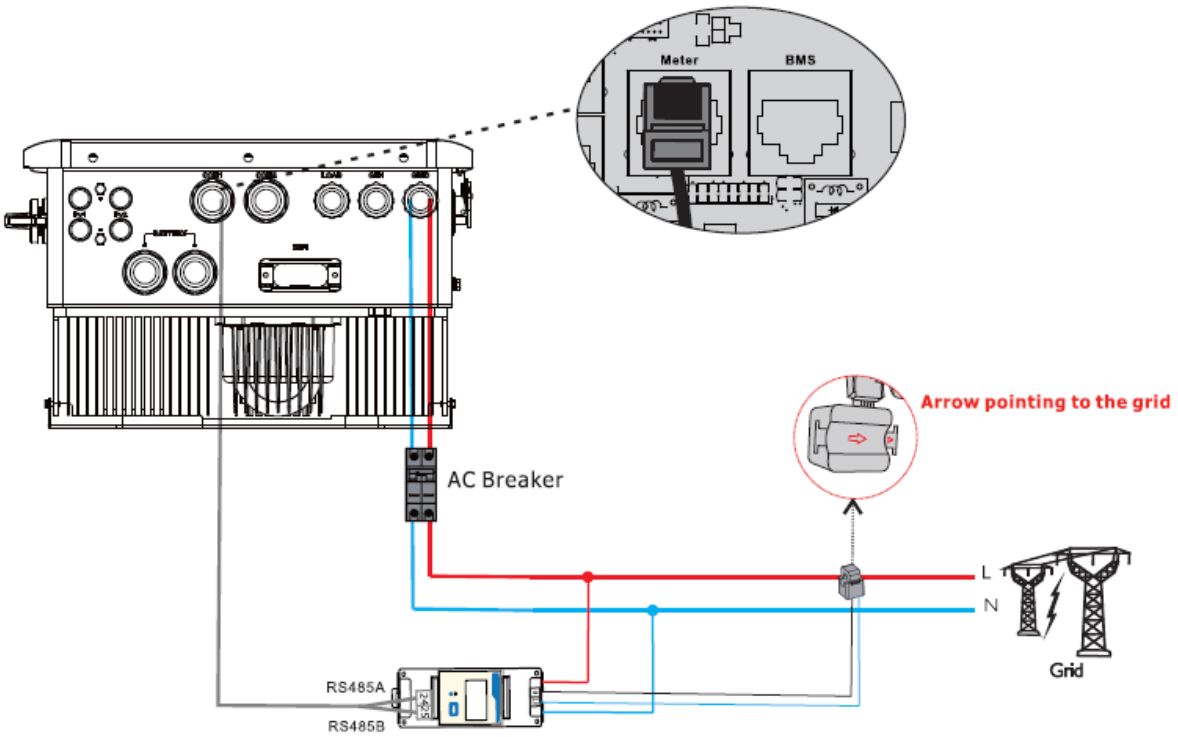
Description of the remote control in a typical installation:



(Grid Type: Single Phase)



Block diagram of the utility interactive inverter:

The DC input of converter can be supplied from PV array and Batteries.

The charging current to batteries can from PV array or Grid through the inversion circuit, battery management unit is integrated in External Energy storage system.

The Hybrid Inverter is a single-phase type; the unit is providing EMC filtering at the output toward mains. The unit doesn't provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high-power switching bridge and relays. This ensures that the opening of the output circuit will also operate in case of one error. And the battery is charged from PV array or Grid.

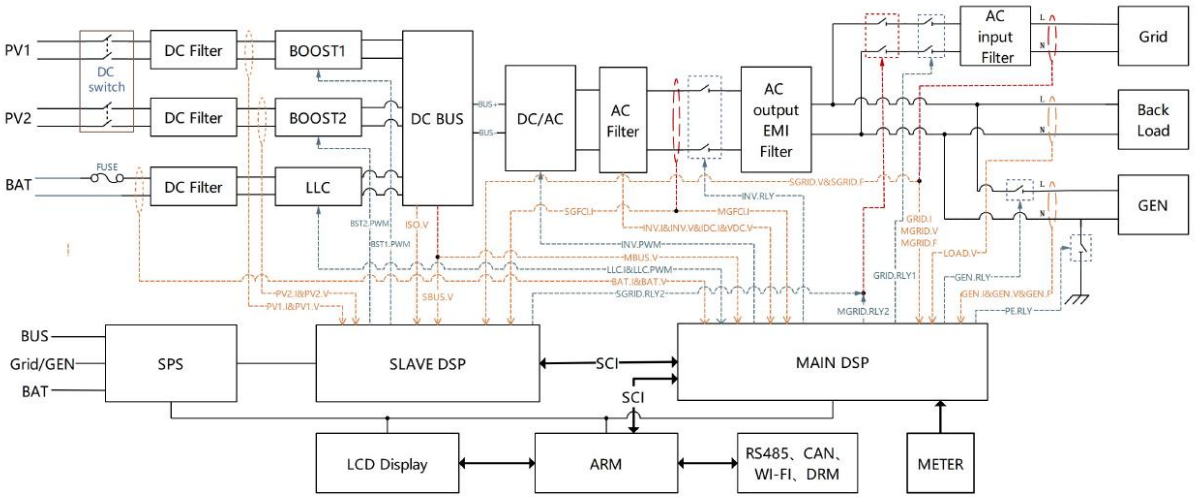
The internal control is redundant built. It consists of Main DSP (U10) and slave DSP (U12).

The Main DSP (U10) can control the relays, measures voltage, and frequency, AC current with injected DC, insulation resistance and residual current, in addition it tests RCMU circuit before each start up.

The slave DSP (U12) is used for controlling the relays, measuring voltage, frequency, injecting a dc AC current, the residual current, and communicating with the master DSP (U10). And if communicating with the master DSP, the slave DSP will disconnect the relays.

The unit provides two relays in series on Line and Neutral conductors. When single fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the battery and the mains. All the relays are tested before starting up. Both controllers Main DSP (U10), Slave DSP (U12) can open the relays.

Figure 1 – Block Diagram for all models



Differences of the models in the series:
All Identically The PGUs IVGM3KLP1G2-24, IVGM3KLP1G2, IVGM3K6LP1G2, IVGM4K6LP1G2, IVGM5KLP1G2 and IVGM6KLP1G2 use the same hardware platform. The PGUs use the same control unit, control system and software. The different powers are realized by software derating. Please refer to parameters table and labels. Therefore, testing of the PGU IVGM6KLP1G2 is applicable for the IVGM3KLP1G2-24, IVGM3KLP1G2, IVGM3K6LP1G2, IVGM4K6LP1G2 and IVGM5KLP1G2.

The product was tested on:

The product(s) with serial number 120606004826220297 was tested on 120606004826220297.

IVGM6KLP1G2	120606004826220297	

Hardware versions: 1.0
Software version: 100

All tests were performed on EUT IVGM6KLP1G2 is valid for the whole series.

Test Report

UNE 217002:2020		
Article	**Test**	**Result**
5. Technical Requirements		
4.1	**Direct Current Injection into the Grid**	**P**
4.2	**Generation of Overvoltages**	**P**
4.3	**Island Operation Detection**	**P**
4.4	**Voltage and Frequency Disconnection**	**P**
4.5	**Power factor fixed**	**P**

4.1 Direct current injection into grid			**P**
Model: IVGM6KLP1G2			
Test result:			
Power Level	33%	66%	100%
Watt (W)	2002,91	3972,57	5990,52
Vrms (V)	230,04	230,15	230,25
Arms (A)	8,71	17,26	26,02
Freq (Hz)	50,00	50,00	50,00
Cosφ	0,9999	1,0000	1,0000
Idc (mA)	7,19	8,17	11,84
DC (%)	0,028	0,031	0,045

Note:

Test method refer UNE 217002:2020 4.1 & TED/749/2020 Anexo I clause 5.3

The investor must ensure that the direct current injected into the network does not exceed the limit value 0,5% of IAC;nom

Established by the implementing regulations.

For this purpose, the following test should be performed:

1) connect the generator to a grid whose dc voltage component is negligible to the Measurement effects,

for example by separating other loads from the network with a separator transformer.

2) set the output power of the generator to an output power between 25% and 100% of its rated power.

3) wait the necessary time until the internal temperature of the generator reaches the regime Stationary (temperature variation less than 2 ° c in 15 min).

4) measure the value of the continuous component injected by the equipment into the network. The test is considered valid if the dc component, measured in an al window Less than 10 s, meets the applicable conformity requirements.

4.1 Direct current injection into grid			**P**
Model: IVGM3KLP1G2			
Test result:			
Power Level	33%	66%	100%
Watt (W)	1002,91	2001,28	3002,53
Vrms (V)	229,99	230,04	230,09
Arms (A)	4,36	8,70	13,05
Freq (Hz)	50,00	50,00	50,00
Cosφ	0,9999	0,9999	0,9999
Idc (mA)	6,93	9,18	9,78
DC (%)	0,053	0,070	0,075

Note:

Test method refer UNE 217002:2020 4.1 & TED/749/2020 Anexo I clause 5.3

The investor must ensure that the direct current injected into the network does not exceed the limit value 0,5% of IAC;nom

Established by the implementing regulations.

For this purpose, the following test should be performed:

1) connect the generator to a grid whose dc voltage component is negligible to the Measurement effects,

for example by separating other loads from the network with a separator transformer.

2) set the output power of the generator to an output power between 25% and 100% of its rated power.

3) wait the necessary time until the internal temperature of the generator reaches the regime Stationary (temperature variation less than 2 ° c in 15 min).

4) measure the value of the continuous component injected by the equipment into the network. The test is considered valid if the dc component, measured in an al window Less than 10 s, meets the applicable conformity requirements.

4.2 Overvoltage Generation **Phase-line（L-N）**						**P**
Model: IVGM6KLP1G2						
	100+/-5% Output Power (VA) Test 1		100+/-5% Output Power (VA) Test 2		100+/-5% Output Power (VA) Test 3	
	Duration (s)	Line to neutral(Un%)	Duration (s)	Line to neutral(Un%)	Duration (s)	Line to neutral (Un%)
Limit	0,0002	±280	0,0002	±280	0,0002	±280
Test value		126,3		128,0		-127,0
Limit	0,0006	±218	0,0006	±218	0,0006	±218
Test value		126,1		128,1		-126,7
Limit	0,002	±178	0,002	±178	0,002	±178
Test value		123,1		125,4		-124,3
Limit	0,006	±145	0,006	±145	0,006	±145
Test value		-1,5		76,8		-38,0
Limit	0,02	±129	0,02	±129	0,02	±129
Test value		-1,6		35,5		-37,5
Limit	0,06	±120	0,06	±120	0,06	±120
Test value		-1,5		34,2		-36,1
Limit	0,2	±120	0,2	±120	0,2	±120
Test value		-1,3		29,8		-31,4
Limit	0,6	±120	0,6	±120	0,6	±120
Test value		-0,8		20,2		-21,3

Note:

Test method refer UNE 217002:2020 4.2 & TED/749/2020 Anexo I clause 2.3.6.

The inverter must not generate surges in its alternating connection, complying with the limits. That the overvoltage limits are met admissible established in ITC-BT-40.

If the LV/HV step-up transformer the overvoltage limits are met admissible established in ITC-RAT-09.

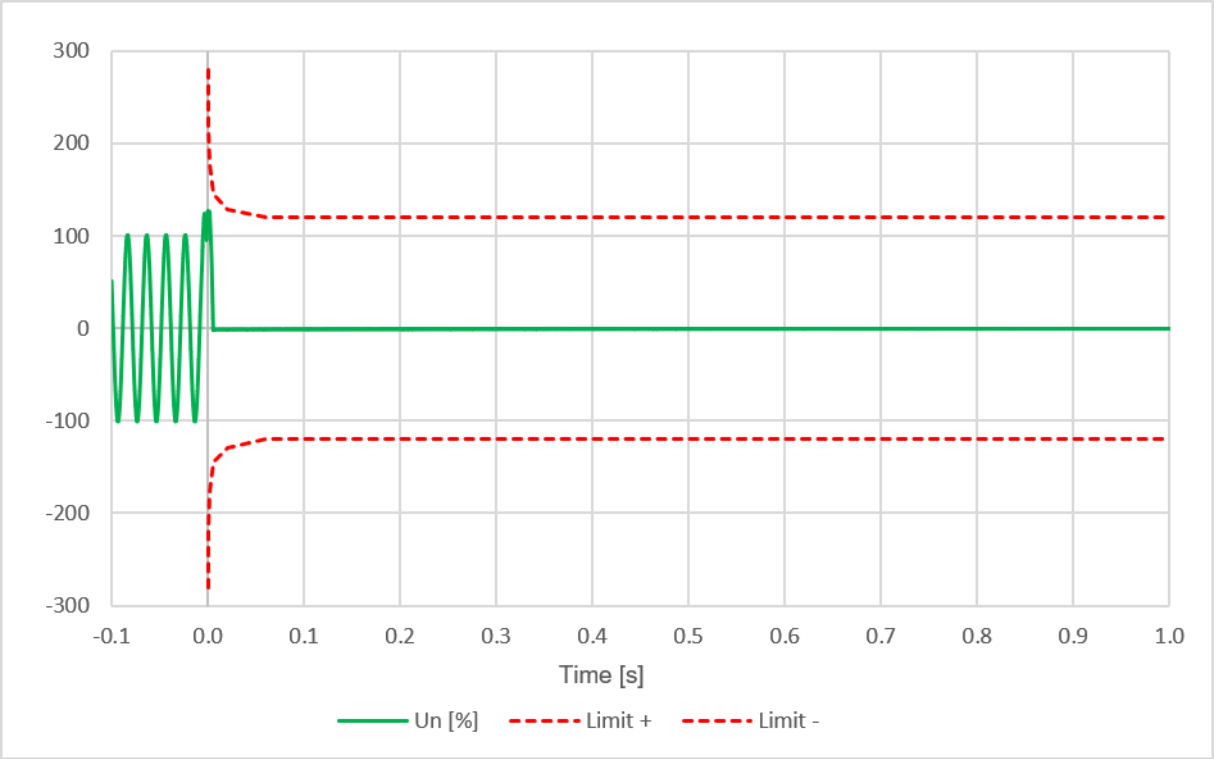
1) The load initially connected to the network and generator set will be greater than 50% of the assigned power of the generator with a mains voltage between ±5% of its face value.

2) Open the S switch and disconnect the initial load so that it is connected to the generator a

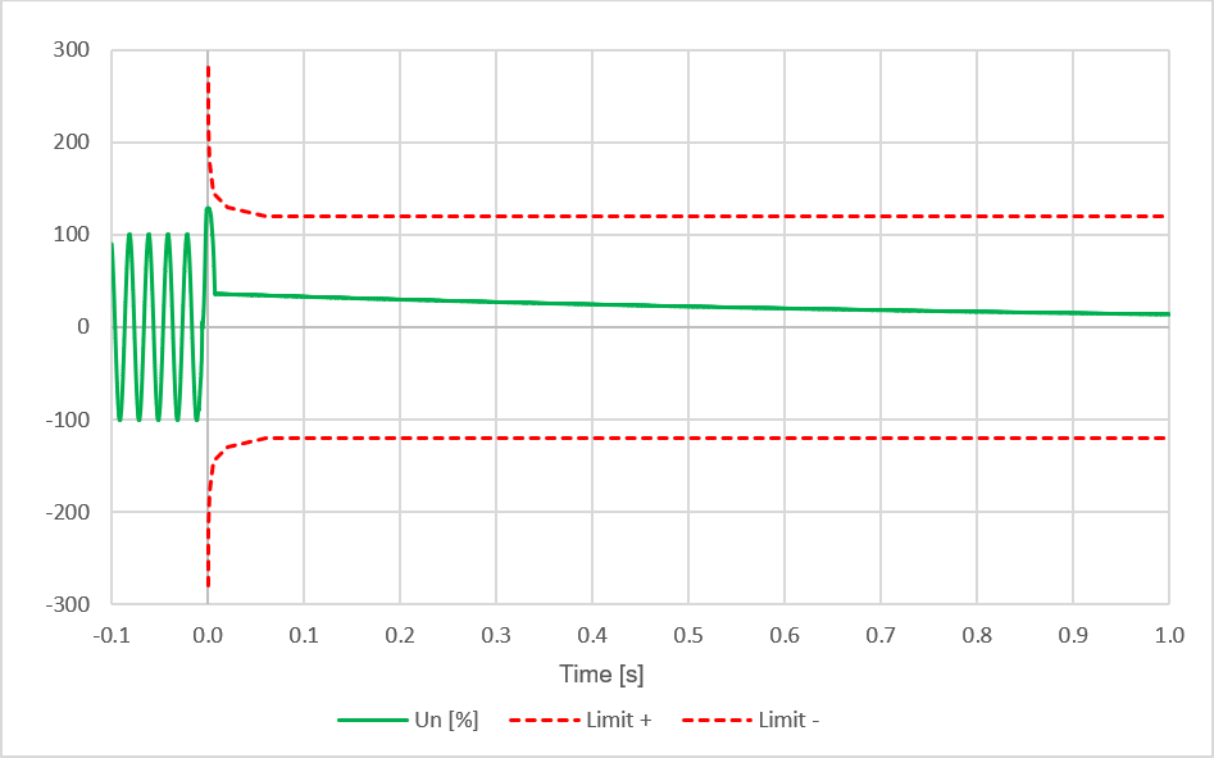
linear residual load that may not exceed 0.1% of the maximum output power of the generator.

3) Record the voltages at the output terminals of the generator, or of the transformer in the case of generators , from the moment of disconnection, with an sampling frequency of at least 10 kHz.

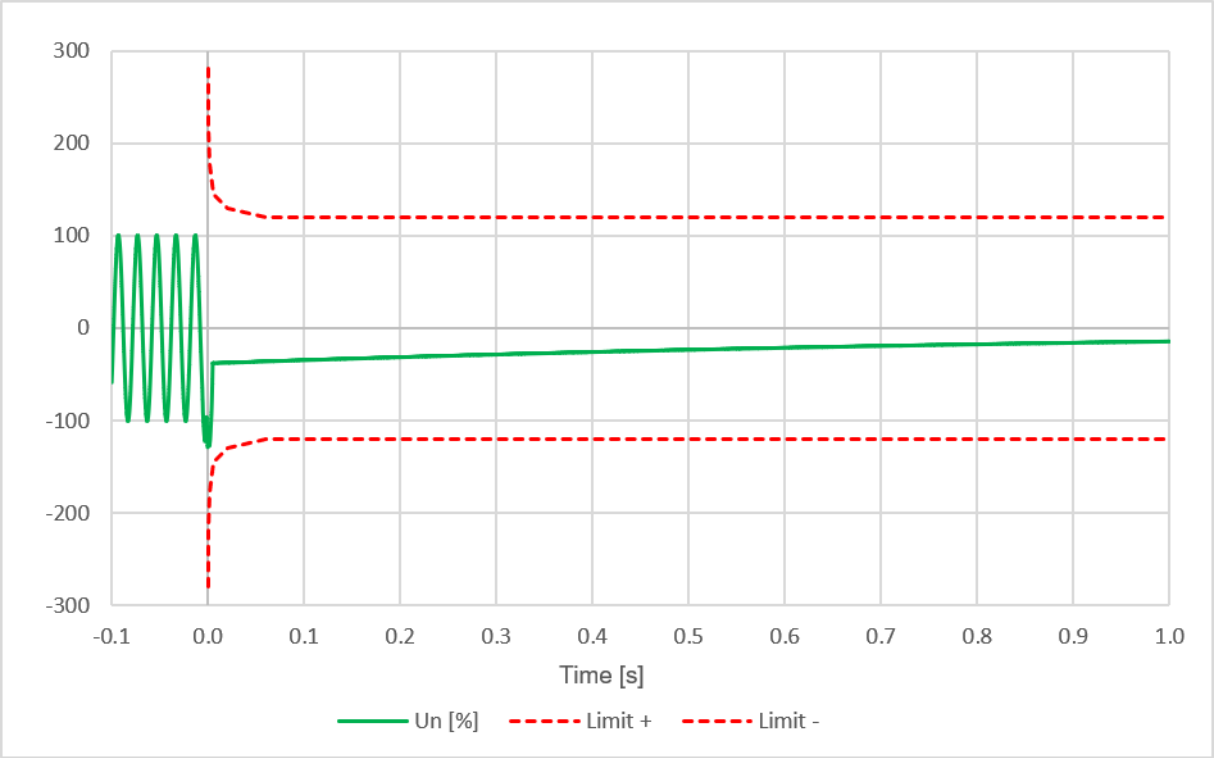
100 %Pn – Test 1



100 %Pn – Test 2



100 %Pn – Test 3


300
200
100
0
-100
-200
-300
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time [s]
Un [%]
Limit +
Limit -

4.3 Island Operation Detection		P
Test circuit and parameters		
Parameter	**Symbol**	**Units**
EUT DC Input		
DC voltage	V_{DC}	V
DC Current	I_{DC}	A
DC Power	P_{DC}	W
EUT AC ouput		
AC voltage	V_{EUT}	V
AC current	I_{EUT}	A
Real power	P_{EUT}	W
Reactive power	Q_{EUT}	VAr
Test Load		
Resistive load current	I_R	A
Inductive load current	I_L	A
Capacitive load current	I_C	A
AC (utility) power source		
Utility real power	P_{AC}	W
Utility reactive power	Q_{AC}	VAr
Utility current	I_{AC}	A

Block diagram test circuit IEC 62116:2014

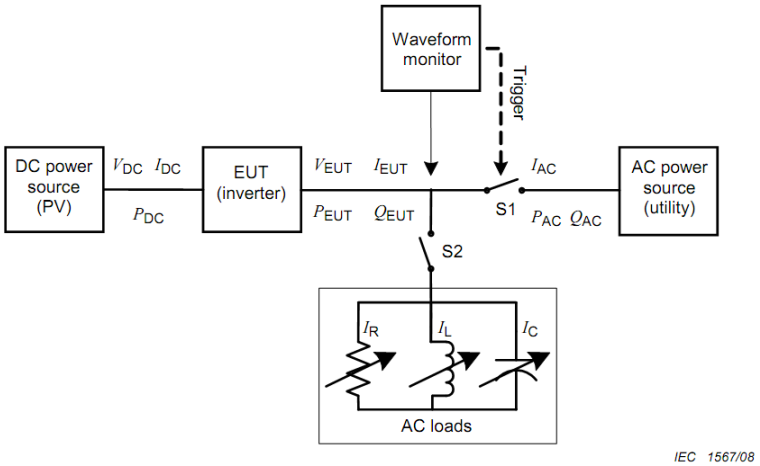


Figure 1 – Test circuit for islanding detection function in a power conditioner (inverter)

Note:
Test 1: Both inverters are feeding in parallel with Anti-Islanding detection activated.
Test 2: Both inverters are feeding in parallel with Anti-Islanding detection deactivated of the second inverter.
Each inverter is generating 50% of the required test-bin.
The testing is based on EN 62116:2014.

4.3 Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)	**P**

TEST 1

Test conditions	Frequency: 50±0,1Hz U_N=230±2,3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} [1)] [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1]	P_{AC} [2)] [% of nominal]	Q_{AC} [3)] [% of nominal]	I_{AC} [4)] [A]	P_{EUT} [W]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks[5)]
1	100	100	0	0	0,199	6000	380	1,000	1,222	BL
2	100	100	-5	-5	--	6000	380	1,026	0,725	IB
3	100	100	-5	0	--	6000	380	1,053	0,932	IB
4	100	100	-5	+5	--	6000	380	1,079	0,727	IB
5	100	100	0	-5	--	6000	380	0,975	0,744	IB
6	100	100	0	+5	--	6000	380	1,025	0,771	IB
7	100	100	+5	-5	--	6000	380	0,928	0,718	IB
8	100	100	+5	0	--	6000	380	0,952	0,832	IB
9	100	100	+5	+5	--	6000	380	0,976	0,726	IB

Parameter at 0% per phase	L= 28,08 mH	R= 8,82 Ω	C= 361,22 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) Fundamental of I_{AC} when RLC is adjusted

5) BL: Balance condition, IB: Imbalance condition.

Condition A:

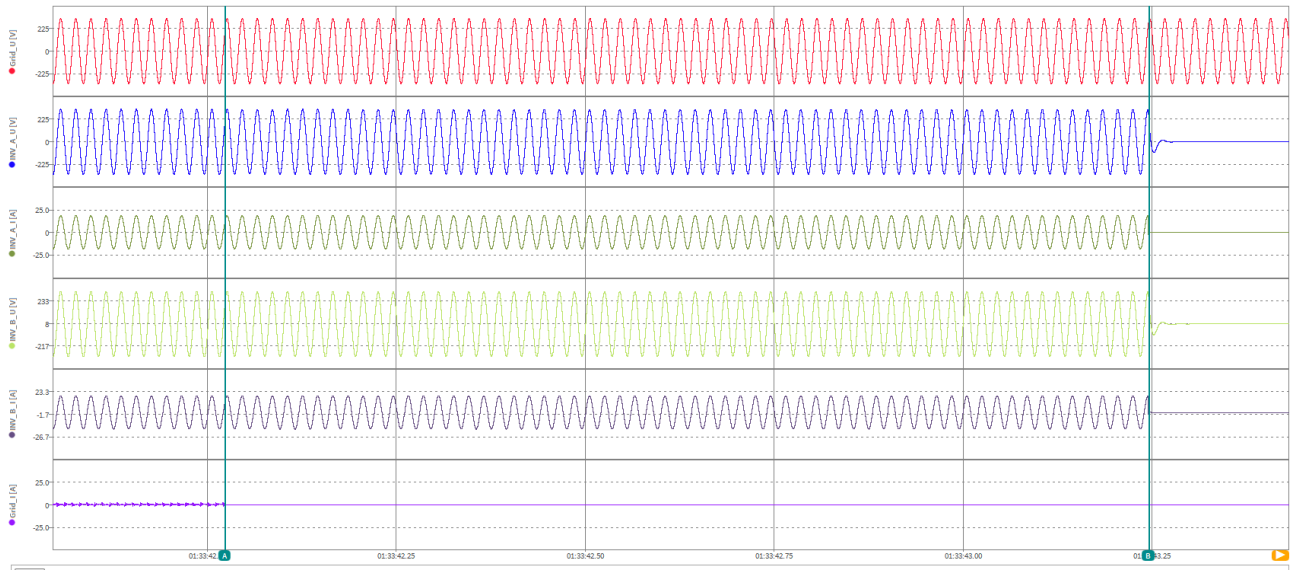
EUT output power PEUT = Maximum 6)

EUT input voltage 6) = >75% of rated input voltage range

6) Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.

7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 90 % of range =X + 0,75 × (Y – X), Y shall not exceed 0,8 × EUT maximum system voltage (i,e,, maximum allowable array open circuit voltage), In any case, the EUT should not be operated outside of its allowable input voltage range.

Disconnection at balance condition



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	01:33:42.024100	01:33:43.245700	1.221600				
Grid_U [V]	155.1397	273.9475	118.8078	-325.8693	325.6710	0.214081	230.2780
INV_A_U [V]	155.5846	297.5767	141.9921	-326.3045	326.6068	1.012965	229.9221
INV_A_I [A]	8.959914	-1.905775	-10.86569	-18.56504	19.28568	0.344737	13.15332
INV_B_U [V]	155.5698	297.6072	142.0374	-326.4077	326.6287	0.974518	229.9685
INV_B_I [A]	8.706332	1.568937	-7.137394	-18.56952	18.73050	0.126686	13.08048
Grid_I [A]	0.429678	4.339e-3	-0.425339	-0.017738	0.429678	4.818e-3	6.384e-3

4.3 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	**P**

Test conditions	Frequency: 50±0,1Hz U_N=230±2,3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1]	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [W]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks 5)
1	66	66	0	-5	--	3960	275	0,975	0,590	IB
2	66	66	0	-4	--	3960	275	0,980	0,662	IB
3	66	66	0	-3	--	3960	275	0,985	0,715	IB
4	66	66	0	-2	--	3960	275	0,990	0,764	IB
5	66	66	0	-1	--	3960	275	0,995	1,009	IB
6	66	66	0	0	0,039	3960	275	1,000	1,077	BL
7	66	66	0	1	--	3960	275	1,005	0,852	IB
8	66	66	0	2	--	3960	275	1,010	0,831	IB
9	66	66	0	3	--	3960	275	1,015	0,816	IB
10	66	66	0	4	--	3960	275	1,020	0,766	IB
11	66	66	0	5	--	3960	275	1,025	0,704	IB

Parameter at 0% per phase	L= 42,54 mH	R= 13,36 Ω	C= 238,40 µF

Note:

RLC is adjusted to min, +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value,

5) Q_{AC}: Reactive power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value,

4) Fundamental of I_{AC} when RLC is adjusted

5) BL: Balance condition, IB: Imbalance condition,

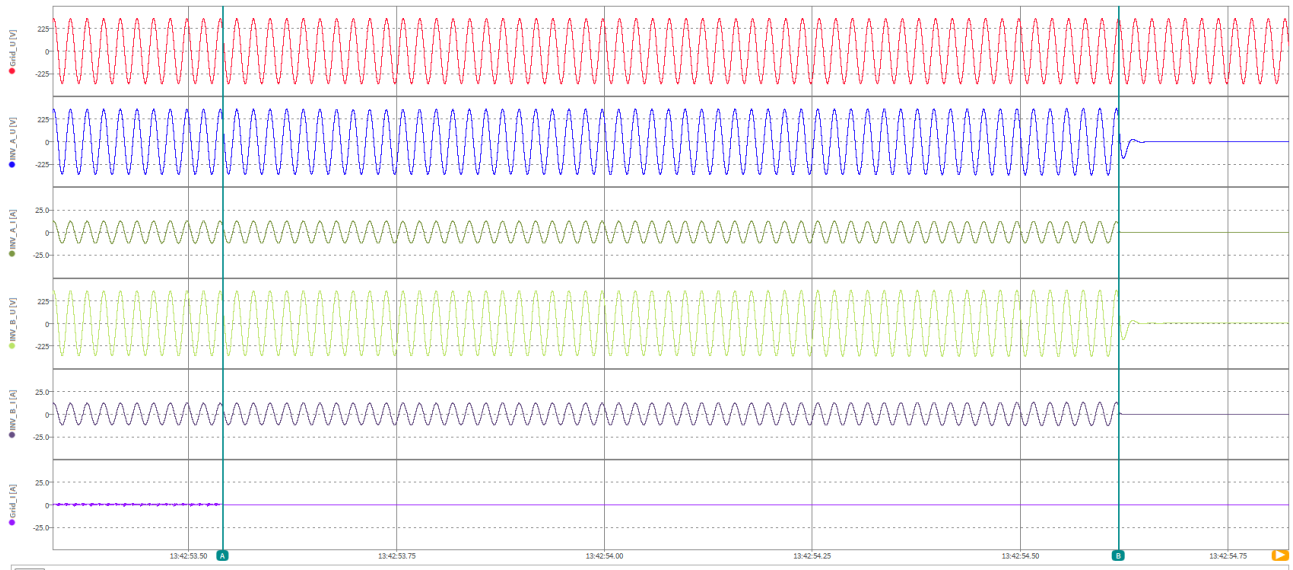
Condition B:

EUT output power P_{EUT} = 50 % – 66 % of maximum

EUT input voltage 6) = 50 % of rated input voltage range, ±10 %

6) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 50 % of range =X + 0,5 × (Y – X), Y shall not exceed 0,8 × EUT maximum system voltage (i,e,, maximum allowable array open circuit voltage), In any case, the EUT should not be operated outside of its allowable input voltage range,

Disconnection at balance condition



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	13:42:53.542000	13:42:54.618700	1.076700				
Grid_U [V]	195.3666	323.4582	128.0916	-325.6636	325.4776	-0.941026	229.9920
INV_A_U [V]	195.8077	251.0073	55.19963	-333.6580	334.2989	0.069359	232.4377
INV_A_I [A]	7.703448	9.335375	1.631928	-12.00118	12.82225	0.383726	8.634078
INV_B_U [V]	195.8165	251.0283	55.21179	-333.7565	334.3396	0.036533	232.4839
INV_B_I [A]	7.196665	9.600020	2.403355	-13.03415	13.10749	0.039282	8.745010
Grid_I [A]	8.106e-3	-9.060e-4	-9.012e-3	-8.106e-3	8.106e-3	5.301e-4	1.508e-3

4.3 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	**P**

Test conditions	Frequency: 50±0,1Hz U_N=230±2,3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1]	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [W]	V_{DC} [V]	Q_f [1]	Run on Time [ms]	Remarks5)
1	33	33	0	-5	--	1900	175	0,975	0,444	IB
2	33	33	0	-4	--	1900	175	0,980	0,494	IB
3	33	33	0	-3	--	1900	175	0,985	0,658	IB
4	33	33	0	-2	--	1900	175	0,990	0,847	IB
5	33	33	0	-1	--	1900	175	0,995	0,912	IB
6	33	33	0	0	0,212	1900	175	1,000	0,968	BL
7	33	33	0	1	--	1900	175	1,005	0,898	IB
8	33	33	0	2	--	1900	175	1,010	0,842	IB
9	33	33	0	3	--	1900	175	1,015	0,747	IB
10	33	33	0	4	--	1900	175	1,020	0,649	IB
11	33	33	0	5	--	1900	175	1,025	0,536	IB

Parameter at 0% per phase	L= 85,09 mH	R= 26,72 Ω	C= 119,20 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) Fundamental of I_{AC} when RLC is adjusted

5) BL: Balance condition, IB: Imbalance condition.

Condition B:

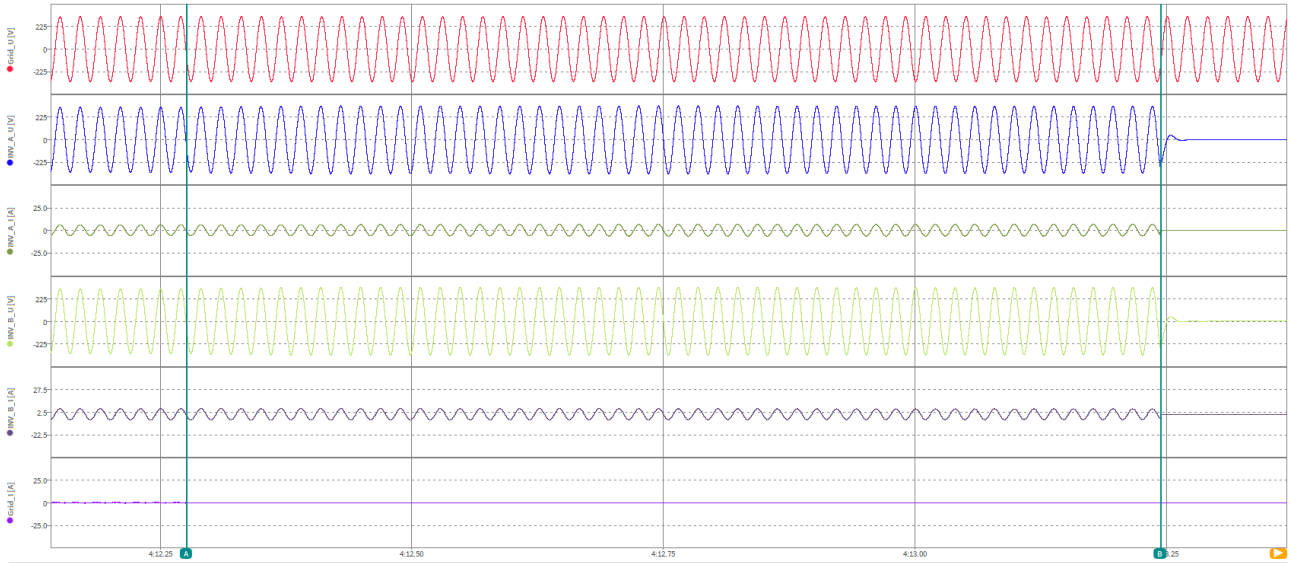
EUT output power PEUT = 25 % – 33 % 6) of maximum

EUT input voltage 7) = <20 % of rated input voltage range

6) Or minimum allowable EUT output level if greater than 33 %.

7) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 10 % of range =X + 0,2 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

Disconnection at balance condition



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	4:12.276500	4:13.244200	0.967700				
Grid_U [V]	-41.90922	-182.7912	-140.8820	-325.7027	325.5310	-2.054426	230.4152
INV_A_U [V]	-41.81719	-262.2531	-220.4359	-341.4338	341.8873	-0.233714	238.9998
INV_A_I [A]	-0.455666	0.266743	0.722408	-6.515217	7.079840	0.343522	4.585894
INV_B_U [V]	-41.85677	-262.3356	-220.4788	-341.5408	341.9159	-0.271493	239.0474
INV_B_I [A]	-0.728703	0.024891	0.753593	-6.313038	6.433583	0.046224	4.346336
Grid_I [A]	-0.059247	-2.384e-5	0.059223	-0.390172	0.012159	6.112e-4	8.661e-3

4.3 Islanding protection according table 6 - Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)	**P**

TEST 2

Test conditions	Frequency: 50±0,1Hz U_N=230±2,3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1]	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks 5)
1	100	100	0	0	0,108	6000	380	1,000	1,148	BL
2	100	100	-5	-5	--	6000	380	1,024	0,713	IB
3	100	100	-5	0	--	6000	380	1,043	0,968	IB
4	100	100	-5	+5	--	6000	380	1,069	0,713	IB
5	100	100	0	-5	--	6000	380	0,974	0,819	IB
6	100	100	0	+5	--	6000	380	1,024	0,855	IB
7	100	100	+5	-5	--	6000	380	0,931	0,735	IB
8	100	100	+5	0	--	6000	380	0,955	0,871	IB
9	100	100	+5	+5	--	6000	380	0,977	0,738	IB

Parameter at 0% per phase	L= 28,08 mH	R= 8,82 Ω	C= 361,22 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) Fundamental of I_{AC} when RLC is adjusted

5) BL: Balance condition, IB: Imbalance condition.

Condition A:

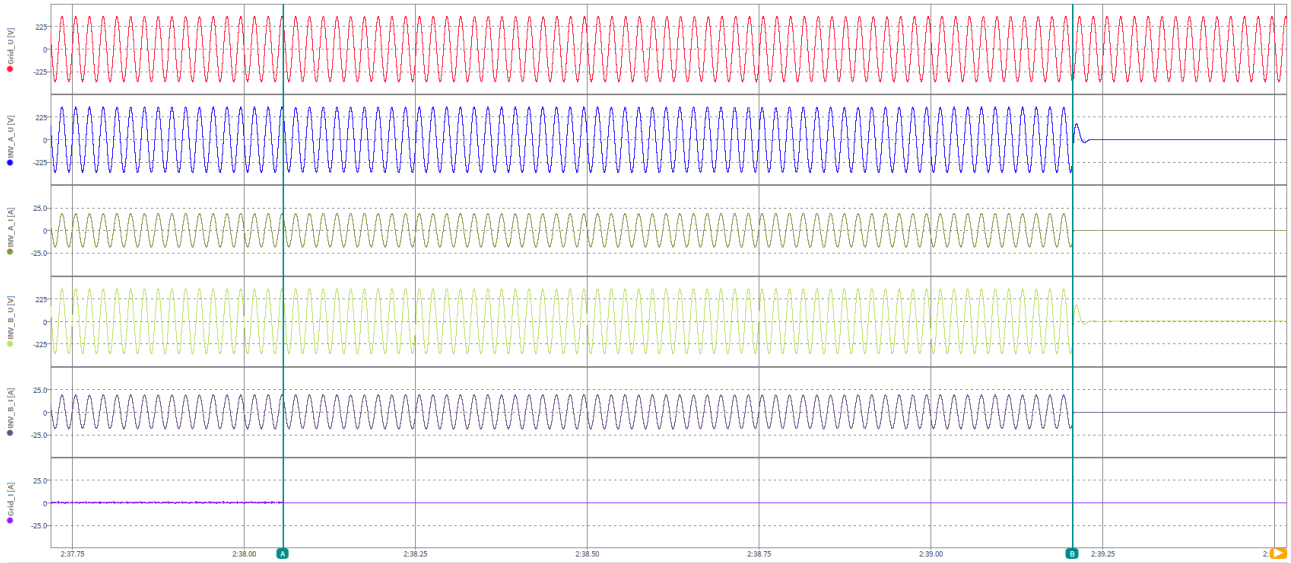
EUT output power PEUT = Maximum 6)

EUT input voltage 6) = >75% of rated input voltage range

6) Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.

7) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 90 % of range =X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

Disconnection at balance condition



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	2:38.057700	2:39.206000	1.148300				
Grid_U [V]	268.3454	-325.0644	-593.4098	-325.8512	325.6531	-0.673015	230.1805
INV_A_U [V]	268.9552	-155.6399	-424.5951	-326.6006	327.1985	-1.109559	230.8320
INV_A_I [A]	15.85980	-0.798607	-16.65840	-18.51597	19.07787	0.280690	13.13164
INV_B_U [V]	268.9731	-155.7143	-424.6874	-326.7043	327.2248	-1.148572	230.8775
INV_B_I [A]	15.69920	0.409412	-15.28978	-18.84022	19.15965	0.093251	13.25400
Grid_I [A]	0.509429	2.003e-3	-0.507426	-0.067282	0.509429	1.818e-3	7.336e-3

4.3 Isla nding protection according Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)	**P**

Test conditions	Frequency: 50±0,1Hz U_N=230±2,3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1]	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks 5)
1	66	66	0	-5	--	3960	275	0,973	0,606	IB
2	66	66	0	-4	--	3960	275	0,978	0,648	IB
3	66	66	0	-3	--	3960	275	0,983	0,713	IB
4	66	66	0	-2	--	3960	275	0,992	0,745	IB
5	66	66	0	-1	--	3960	275	0,997	0,994	IB
6	66	66	0	0	0,116	3960	275	1,000	1,006	BL
7	66	66	0	1	--	3960	275	1,005	0,839	IB
8	66	66	0	2	--	3960	275	1,010	0,830	IB
9	66	66	0	3	--	3960	275	1,015	0,801	IB
10	66	66	0	4	--	3960	275	1,019	0,734	IB
11	66	66	0	5	--	3960	275	1,025	0,674	IB

Parameter at 0% per phase	L= 42,54 mH	R= 13,36 Ω	C= 238,40 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) Fundamental of I_{AC} when RLC is adjusted

5) BL: Balance condition, IB: Imbalance condition.

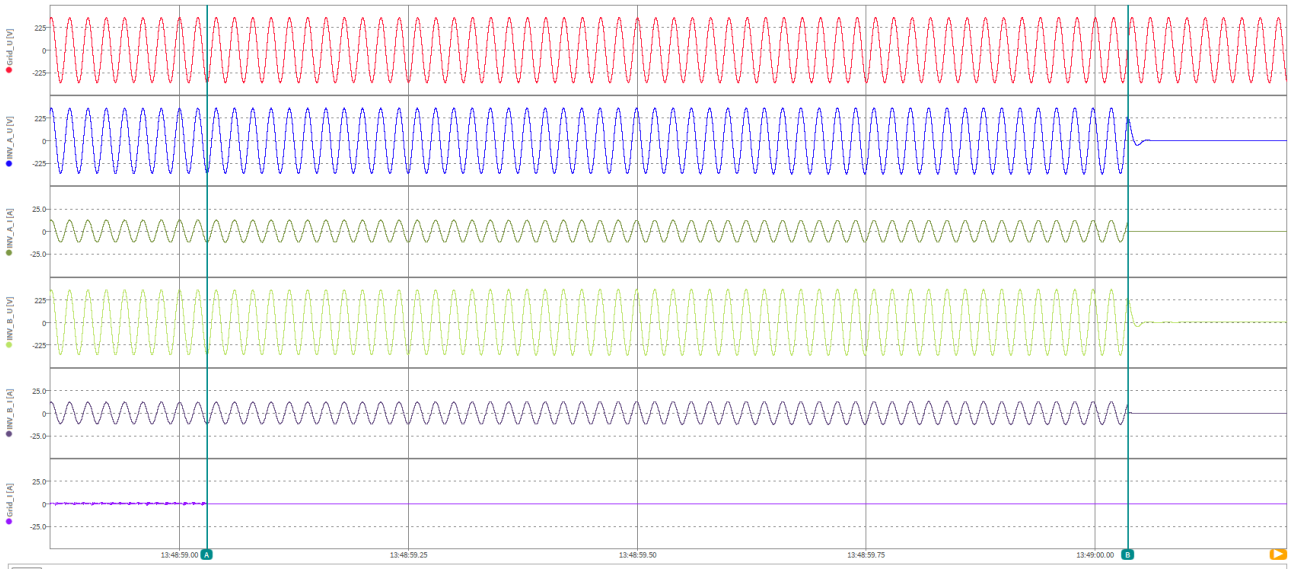
Condition B:

EUT output power P_{EUT} = 50 % – 66 % of maximum

EUT input voltage 6) = 50 % of rated input voltage range, ±10 %

6) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 50 % of range =X + 0,5 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

Disconnection at balance condition



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	13:48:59.030400	13:49:00.036200	1.005800				
Grid_U [V]	-324.2088	49.68214	373.8909	-325.6967	325.5129	-1.221217	230.1697
INV_A_U [V]	-324.2572	248.7617	573.0188	-331.3649	331.8560	-0.518719	233.2669
INV_A_I [A]	-11.94158	-1.376867	10.56471	-12.12459	12.74881	0.360231	8.587233
INV_B_U [V]	-324.3504	248.7862	573.1366	-331.4626	331.8875	-0.550907	233.3138
INV_B_I [A]	-12.00943	-0.165129	11.84430	-12.73704	12.92281	0.013505	8.842488
Grid_I [A]	-0.027418	-9.537e-5	0.027323	-0.027418	0.011587	4.264e-4	1.572e-3

4.3 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)	**P**

Test conditions	Frequency: 50±0,1Hz U_N=230±2,3Vac Distortion factor of chokes < 2% Quality = 1
Disconnection limit	2s (IEC 62116)

No	P_{EUT} 1) [% of EUT rating]	Reactive load [% of Q_L in 6.1.d) 1]	P_{AC} 2) [% of nominal]	Q_{AC} 3) [% of nominal]	I_{AC} 4) [A]	P_{EUT} [W per phase]	V_{DC} [V]	Q_f [1]	Run on Time [s]	Remarks 5)
1	33	33	0	-5	--	1900	175	0,968	0,389	IB
2	33	33	0	-4	--	1900	175	0,973	0,674	IB
3	33	33	0	-3	--	1900	175	0,976	0,667	IB
4	33	33	0	-2	--	1900	175	0,991	0,815	IB
5	33	33	0	-1	--	1900	175	0,995	0,894	IB
6	33	33	0	0	0,208	1900	175	1,000	0,996	BL
7	33	33	0	1	--	1900	175	1,005	0,878	IB
8	33	33	0	2	--	1900	175	1,010	0,843	IB
9	33	33	0	3	--	1900	175	1,015	0,749	IB
10	33	33	0	4	--	1900	175	1,020	0,668	IB
11	33	33	0	5	--	1900	175	1,025	0,525	IB

Parameter at 0% per phase	L= 85,09 mH	R= 26,72 Ω	C= 119,20 µF

Note:

RLC is adjusted to min. +/-1% of the inverter rated output power

1) P_{EUT}: EUT output power

2) P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

4) Fundamental of I_{AC} when RLC is adjusted

5) BL: Balance condition, IB: Imbalance condition.

Condition B:

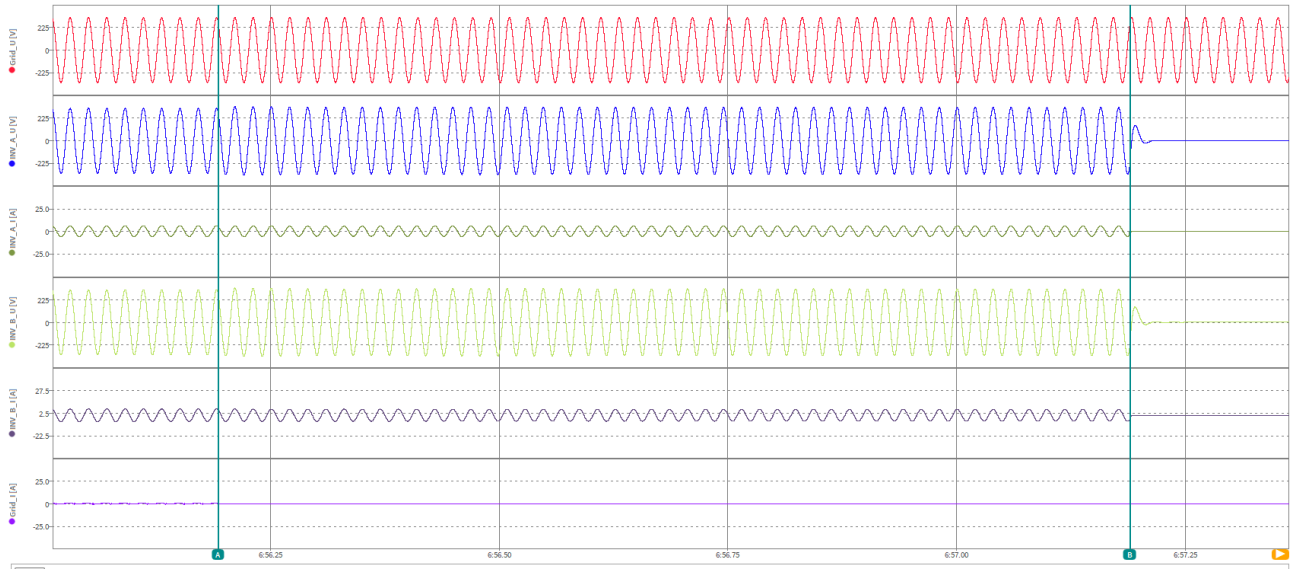
EUT output power PEUT = 25 % – 33 % 6) of maximum

EUT input voltage 7) = <20 % of rated input voltage range

6) Or minimum allowable EUT output level if greater than 33 %.

7) Based on EUT rated input operating range. For example, If range is between X volts and Y volts, 10 % of range =X + 0,2 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

Disconnection at balance condition



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	6:56.193600	6:57.189800	0.996200				
Grid_U [V]	275.5182	262.3537	-13.16452	-325.7098	325.5136	-1.236852	229.8628
INV_A_U [V]	283.3009	-218.3042	-501.6051	-342.3405	343.2498	-1.062938	237.7952
INV_A_I [A]	5.363179	-1.078987	-6.442166	-5.733681	6.329584	0.331168	4.149104
INV_B_U [V]	283.3243	-218.3902	-501.7145	-342.4473	343.2813	-1.098999	237.8426
INV_B_I [A]	5.929470	-1.567364	-7.496834	-6.847382	6.979895	0.012631	4.735982
Grid_I [A]	9.537e-4	8.106e-4	-1.431e-4	-2.003e-3	4.101e-3	1.146e-3	1.351e-3

4.4 Voltage and Frequency Disconnection									**P**
4.4.1 Voltage Monitoring									**P**
Model: IVGM6KLP1G2									
Test conditions:	Uac=230,6 V Iac=25,73 A Pac=5933,2 W fac=50,00 Hz								
	under voltage				**over voltage (stage 1)**				
Parameter	Voltage	Time [ms]			Voltage	Time [ms]			
Limit	**195,5 V**	**<= 1500 ms***			**253,0 V**	**<= 1500 ms**			
Trip value[V]	200,5 to 190,5	195,09	195,08	195,05	248,0 to 258,0	253,03	253,04	253,04	
Disconnection time [ms]	230 to 190,5	1452	1477	1453	230 to 258,0	1449	1465	1464	
Reconnection time:	**>=180 s**	206,4 s			**>=180 s**	206,4 s			
--	--				**over voltage (stage 2)**				
Parameter	--				Voltage	Time (ms)			
Limit	-- --				**264,5 V**	**<= 200 ms**			
Trip value[V]	--				248,0 to 269,5	264,63	264,66	264,67	
Disconnection time [ms]	--				230 to 269,5	191	189	183	
Reconnection time:	--				**>=180 s**	206,2 s			

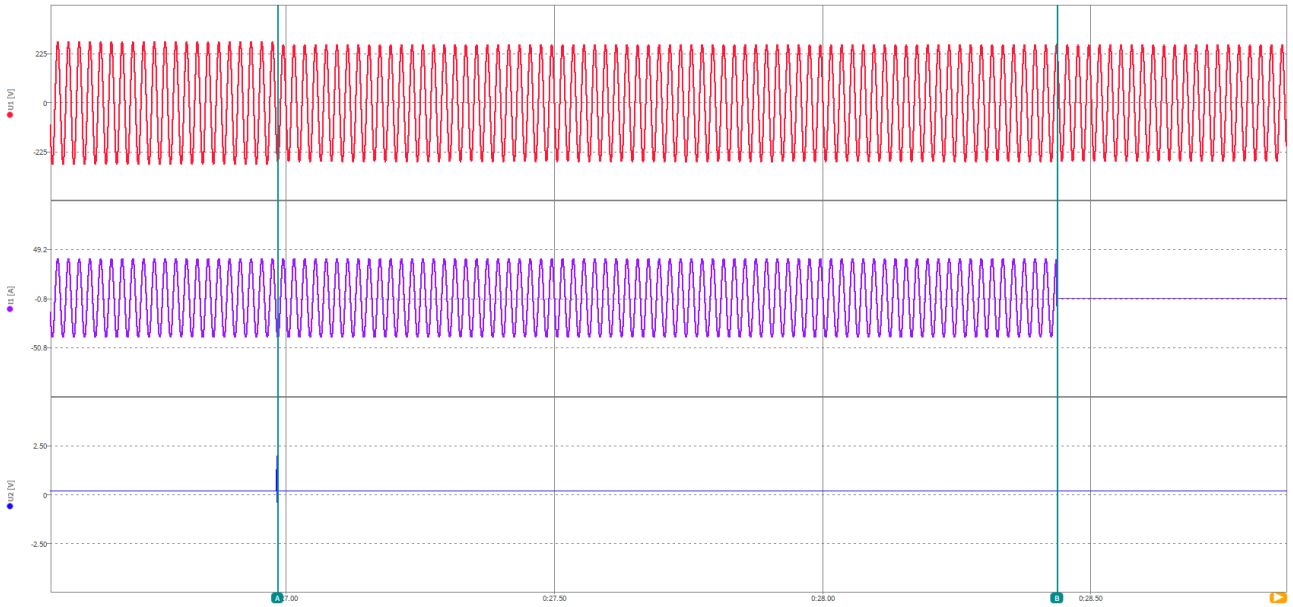
Note:

The test is based on the limits of TED/749:2020, RD647:2020.

The maximum and minimum voltage connection protection must be set to Un +10% (stage 1), Un +15% (stage 2) and Un -15%. The accuracy for the voltage measurement must be in a range of +/-2,3V (1% $U_{nom.}$).

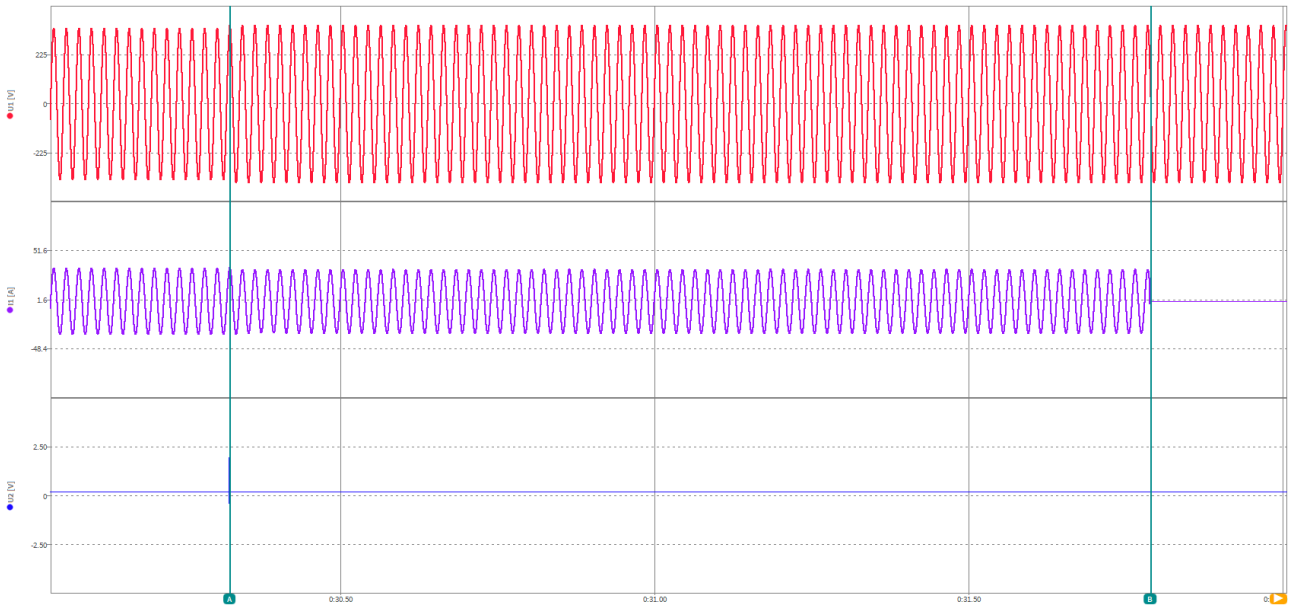
* In case of facilities required to meet performance requirements against voltage sags. The time performance should be equal to 1,5 s.

Under Voltage:



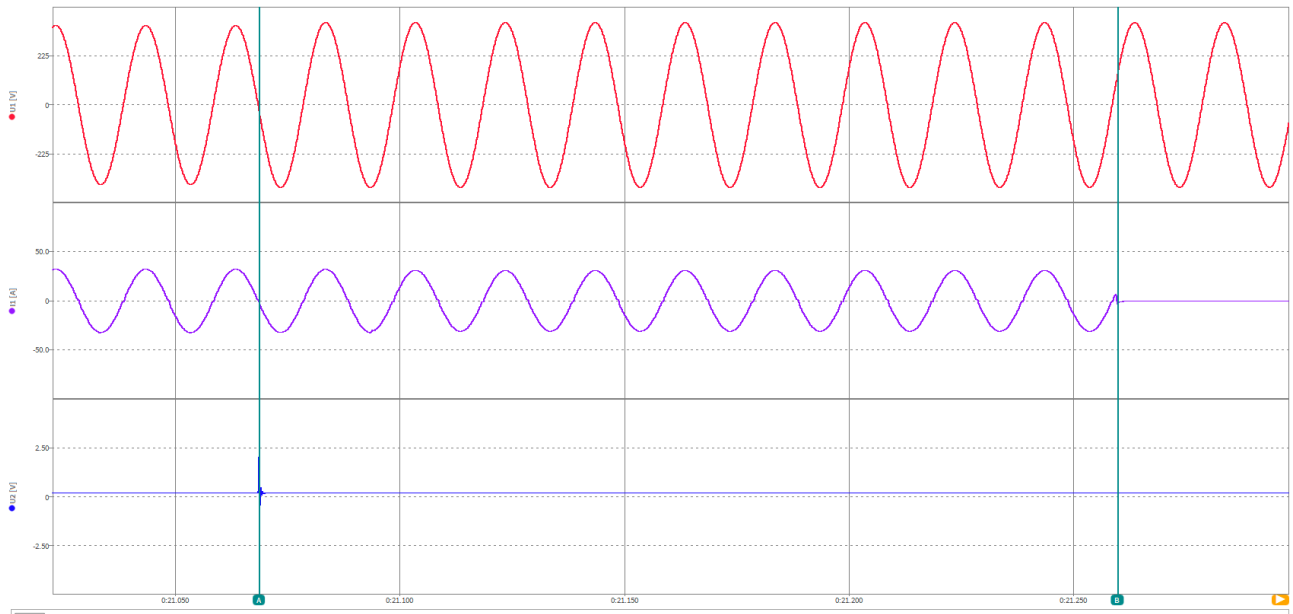
	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	0:26.98580	0:28.43740	1.45160				
U1 [V]	-231.4270	262.3999	493.8269	-270.8483	270.7067	-0.417192	191.4256
I1 [A]	-36.43232	-8.012915	28.41940	-40.14611	40.72509	-0.059717	28.72686
U2 [V]	2.009869	0.203609	-1.806259	-0.396013	2.009869	0.203092	0.203754

Over Voltage (stage 1):

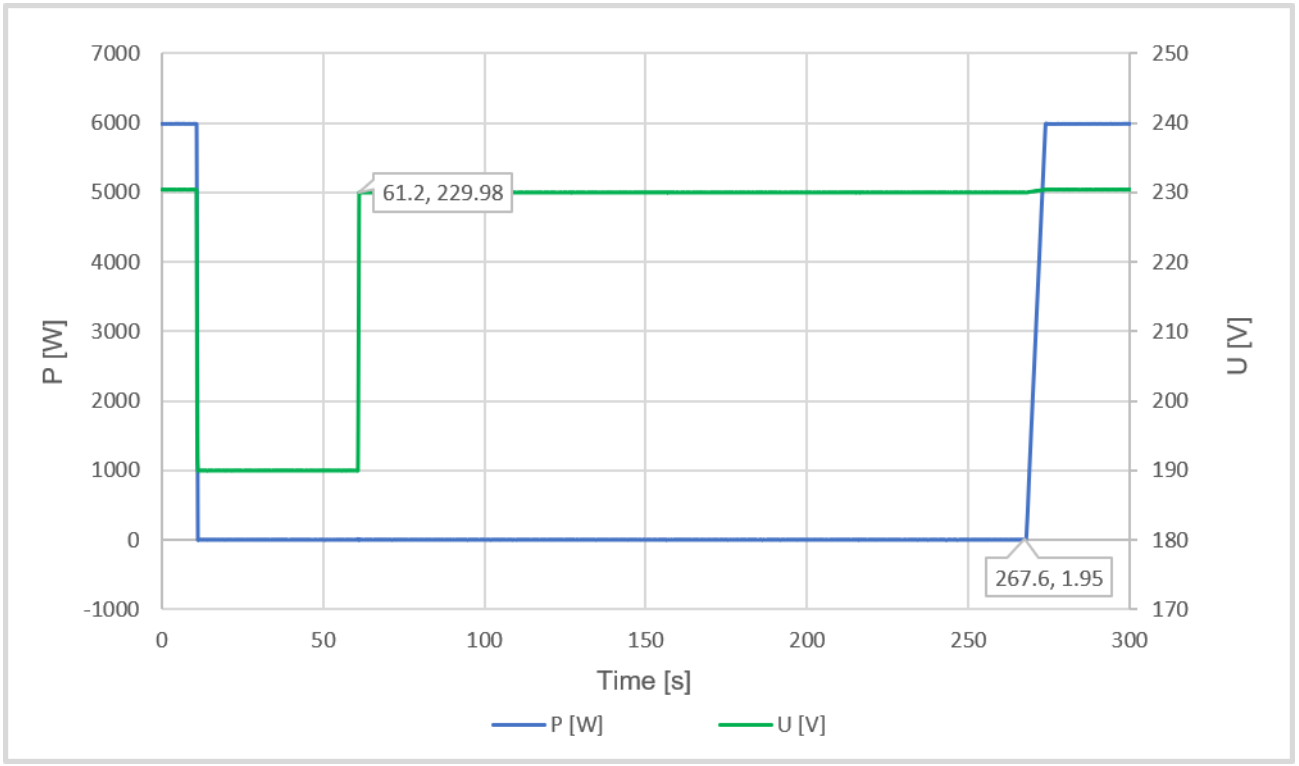


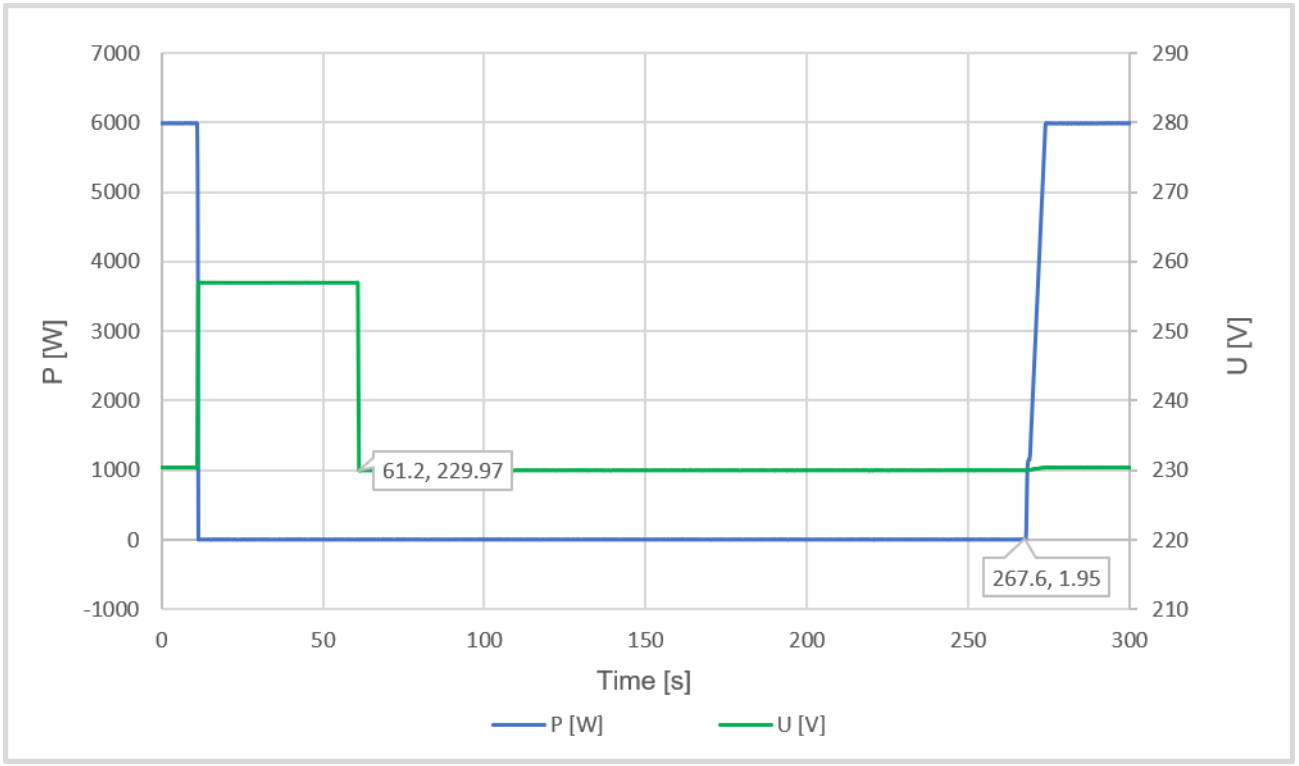
	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	0:30.32490	0:31.78940	1.46450				
U1 [V]	343.1130	167.8505	-175.2625	-364.9476	365.0255	0.900106	258.1585
I1 [A]	30.16067	-2.600289	-32.76096	-33.89607	35.13670	0.077486	23.19676
U2 [V]	1.976013	0.205994	-1.770020	-0.385284	1.976013	0.207160	0.207768

Over Voltage (stage 2):

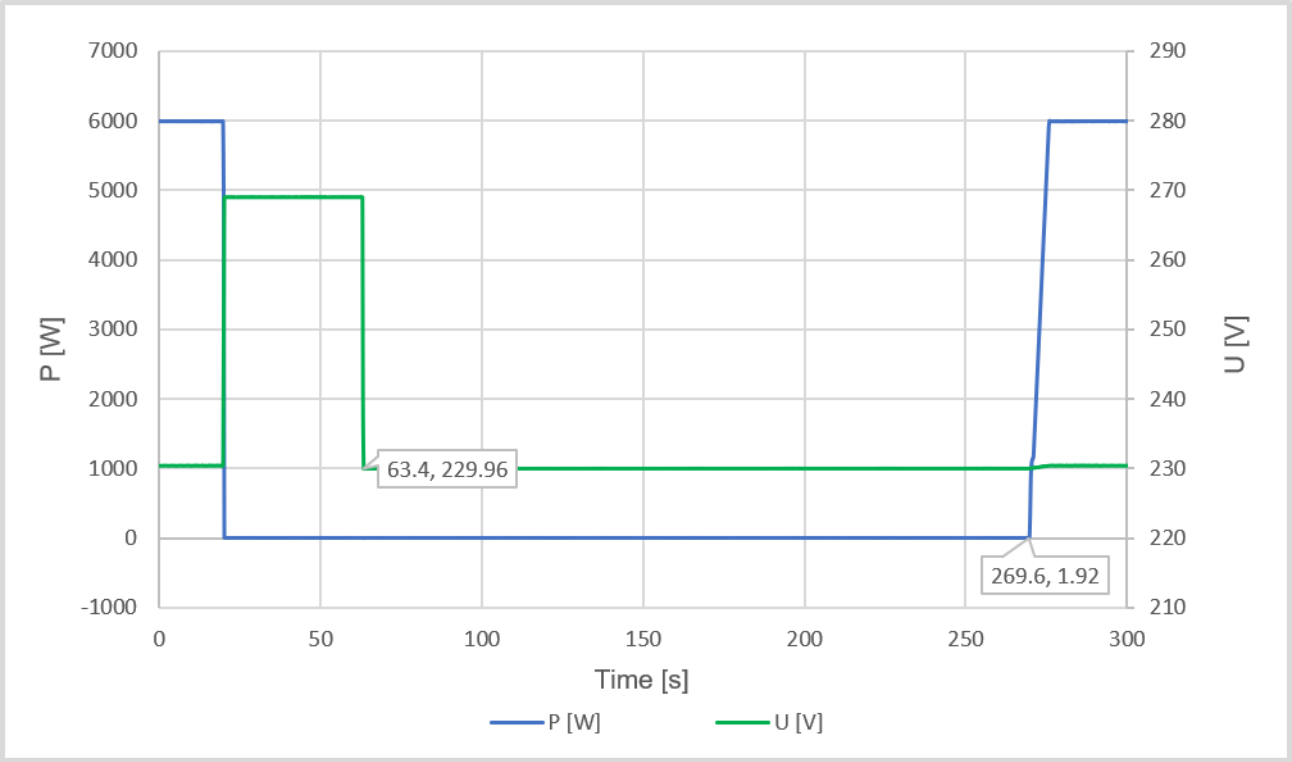


	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	0:21.06880	0:21.25980	0.19100				
U1 [V]	-27.31919	140.8904	168.2096	-381.1457	381.1014	-12.24114	268.7545
I1 [A]	-0.613833	-1.543617	-0.929785	-32.66359	32.55234	-1.067587	22.19013
U2 [V]	2.043724	0.193834	-1.849890	-0.416040	2.043724	0.193952	0.199427

Under Voltage Reconnection


Over Voltage Reconnection (stage 1)


Over Voltage Reconnection (stage 2)



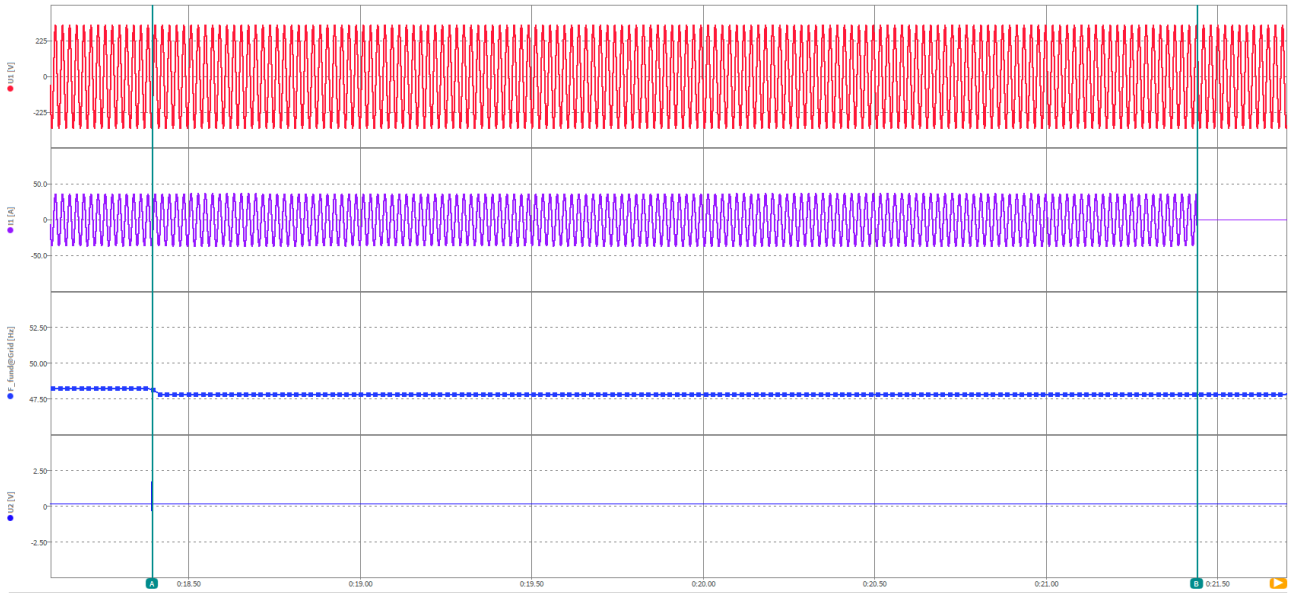
4.4.2 Frequency monitoring									**P**
Model: IVGM6KLP1G2									
Test conditions:	Uac=230,6 V Iac=25,73 A Pac=5933,2 W fac=50,00 Hz								
	Under frequency				**Over frequency**				
Parameter	Frequency [Hz]	Time [ms]			Frequency [Hz]	Time [ms]			
Output Voltage		**~85%U_N**	**U_N**	**~110%U_N**		**~85%U_N**	**U_N**	**~110%U_N**	
Limit	**48,0 Hz**	**at least 3 s**			**51,0 Hz**	**<= 500 ms**			
Trip value [Hz]	48,0	48,00	48,00	48,00	51,0	51,00	51,00	51,00	
Disconnection time [ms]	48,5Hz To 48Hz	3039	3041	3044	50Hz To 51,0 Hz	489	485	479	
Reconnection time:	**>=180 s**	221,2 s			**>=180 s**	202,8 s			

Note:

The test is based on the limits of TED/749:2020, RD647:2020.

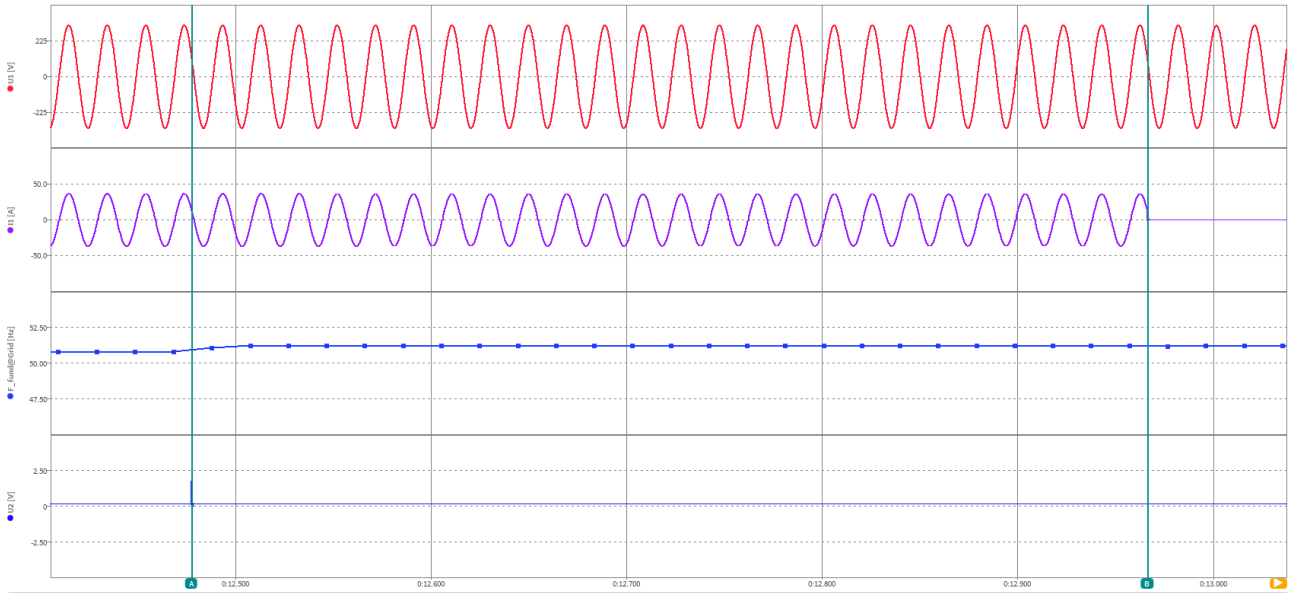
The maximum and minimum frequency connection protection must be set to 51,0 Hz and 48,0 Hz. For an under frequency failure the inverter has to stay connect for at least 3 s. After the 3 s the inverter has to disconnect immediately from the grid. The accuracy for the frequency measurement must be in a range of +/- 0,05 Hz.

Under frequency

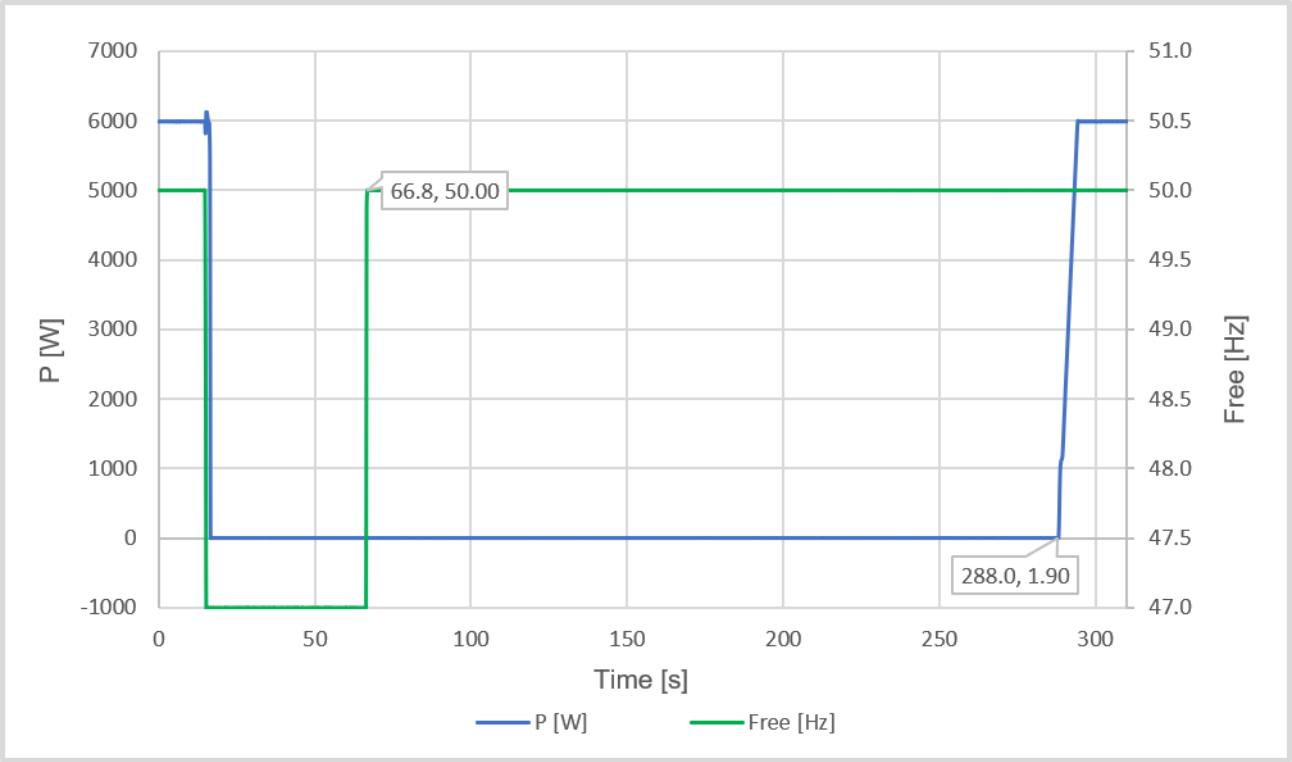


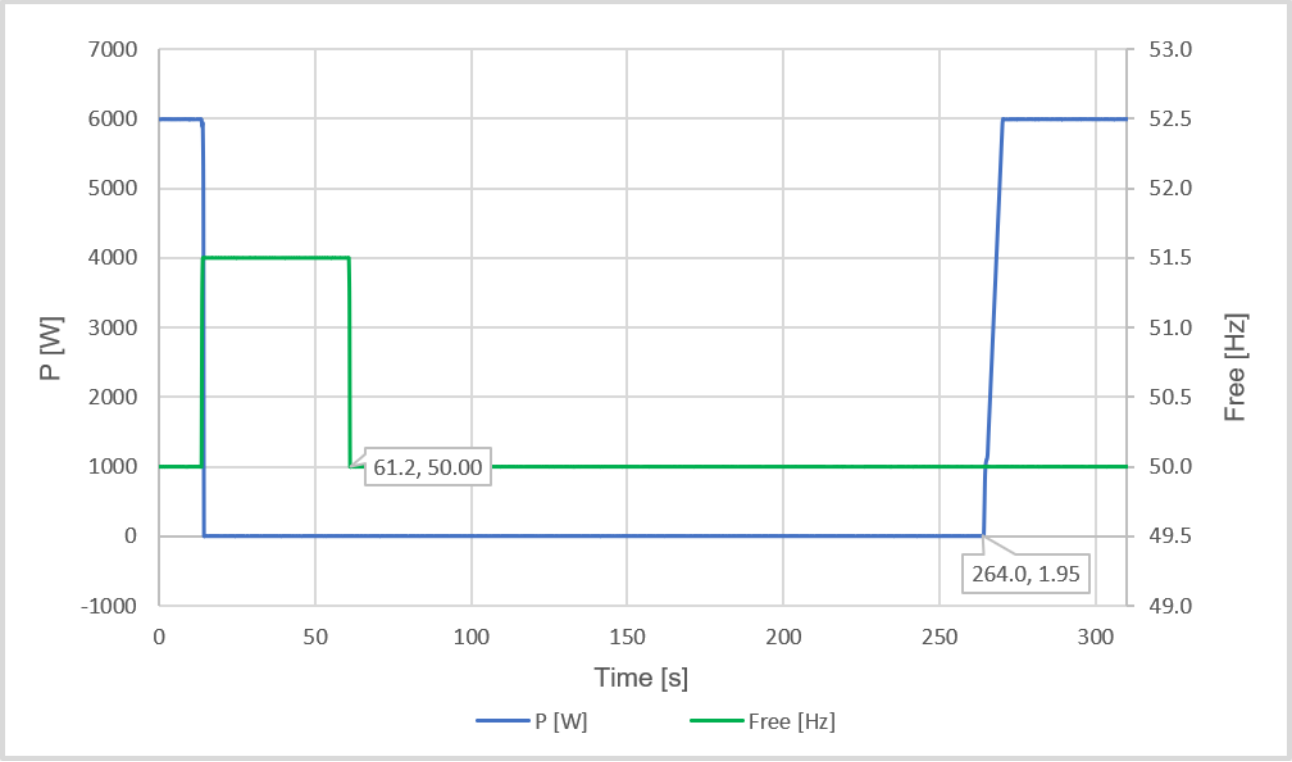
	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	0:18.39580	0:21.43950	3.04370				
U1 [V]	-311.5473	317.0219	628.5692	-325.9468	325.8629	0.114641	230.3724
I1 [A]	-34.75466	3.610563	38.36522	-37.17566	37.48899	6.243e-3	26.01355
F_fund@Grid [Hz]	48.19979	47.79611	-0.403683	47.79611	48.19979	47.80461	47.80463
U2 [V]	1.678228	0.202656	-1.475573	-0.275373	1.678228	0.202995	0.203204

Over frequency



	A	B	间隔	最小值	最大值	平均	有效值
时间 [s]	0:12.47780	0:12.96630	0.48850				
U1 [V]	123.7214	100.5976	-23.12374	-325.9609	325.8803	-8.260e-3	230.3254
I1 [A]	14.16936	-1.250553	-15.41991	-37.14938	37.44107	-0.010420	25.95792
F_fund@Grid [Hz]	50.79940	51.20081	0.401409	50.79940	51.20083	51.17773	51.17780
U2 [V]	1.787663	0.203371	-1.584292	-0.323057	1.787663	0.204725	0.206159

Under frequency Reconnection


Over frequency Reconnection


4.5 Power factor fixed	P

Model: IVGM6KLP1G2

Test result:

Cos phi=1 no reactive power supply

Rating power (%)	Active power [W]	Reactive power [Var]	Power factor [cos φ]	Voltage [V]
5%	301,4	25,5	0,9964	229,95
10%	601,9	29,3	0,9988	229,97
20%	1200,8	35,3	0,9996	230,00
30%	1801,4	52,8	0,9996	230,03
40%	2401,6	68,7	0,9996	230,06
50%	3003,1	81,2	0,9996	230,09
60%	3604,6	81,1	0,9997	230,12
70%	4204,3	90,4	0,9998	230,15
80%	4804,4	99,1	0,9998	230,18
90%	5408,2	75,4	0,9999	230,22
100%	5998,4	86,2	0,9999	230,24

Assessment criterion:

The power factor resulting in each of the measurement points between 25 % and 100 % of the nominal power the power factor must be higher than 0,98.

Note:

a) 1 min-average-values shall be calculated using measurements at the basic frequency in a period of 200 ms.

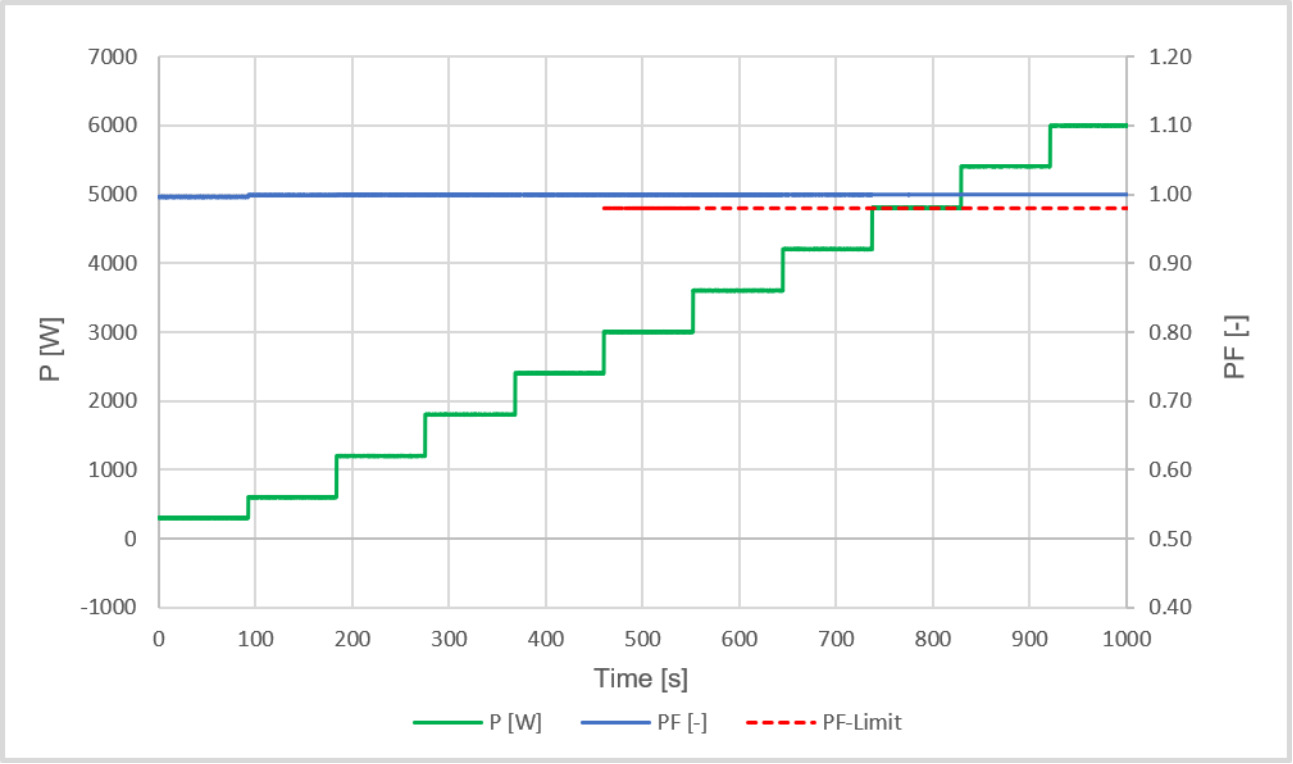
b) For each of the 10 active power levels, at least 3 under excited and 3 over excited reactive power levels shall be recorded.

c) 1 min-average-values have to be calculated using voltage measurements at the basic frequency in a period of 200 ms.

Test:

The test method refer to Real Decreto 647/2020

Graph of the setting accuracy:



Annex 1
Datasheet of the relay

Datasheet of the relay

Churod Electronics
东莞市中汇瑞德电子股份有限公司
DongGuan Churod Electronics Co., Ltd.

RELAY SPECIFICATION

继电器规格书

(File No.: 001411/ Version: 02 / Issued Date: Dec. 30th, 2021/Updated Date: Sep. 13th, 2022)

Product Description（品名） **CHFN-V-112H1A2F(50A)**
Part Number（编码）
Customer（客户）

Customer Approval （客户批准）

STAMPING AREA （盖章处）

Issued（发行）	Checked（审核）	Approved（承认）
Qingwu Feng	Simon Fu	Andy Tang

Datasheet of the relay

Churod Electronics
东莞市中汇瑞德电子股份有限公司
DongGuan Churod Electronics Co., Ltd.

CHANGE RESUME 变更记录			
序号	更改内容	更改原因	更改时间
00	首版发行	/	20211230
01	增加安规认证	增加安规认证编号	20220817
02	触点间隙变更为 2.0mm 以上	客户要求	20220913

SAFETY STANDARD 安全标准	
UL certificate UL 证书	E341422
TUV certificate TUV 证书	R50220099
CQC certificate CQC 证书	CQC11002066606

COIL CHARACTERISTICS 线圈特性

Coil resistance 线圈电阻	90±10% Ω
Rated voltage 额定电压	12VDC
Max. allowable voltage 最大允许电压	130% 额定电压
Rated power 额定功率	1.6W
Operate voltage 吸合电压	≤9.0VDC 23℃ ≤10.8VDC 85℃
Hold Voltage (See Notes 4) 保持电压	4.8~6.0 VDC 23℃ 5.4~6.6VDC 85℃
Release voltage 释放电压	≥0.6VDC

CONTACT RATINGS 触点规格

Contact configuration 触点结构	1 Form A (SPST)
Contact material 触点材料	Ag Alloy
Initial contact resistance 初始接触电阻	≤100mΩ at 6VDC/1A
Rated switching voltage (Normally Open) 额定切换电压（常开触点）	277VAC

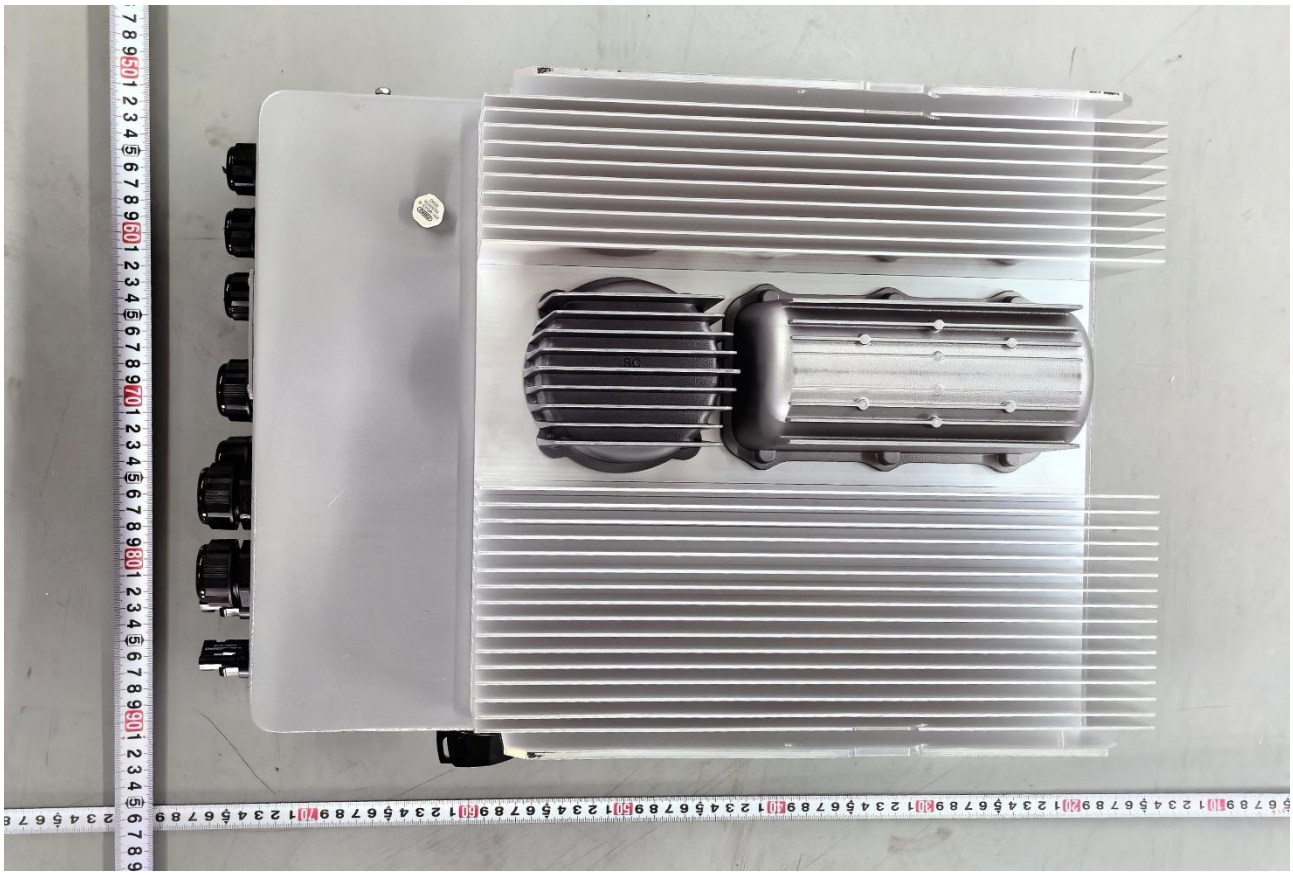
Datasheet of the relay

Churod Electronics
东莞市中汇瑞德电子股份有限公司
DongGuan Churod Electronics Co., Ltd.

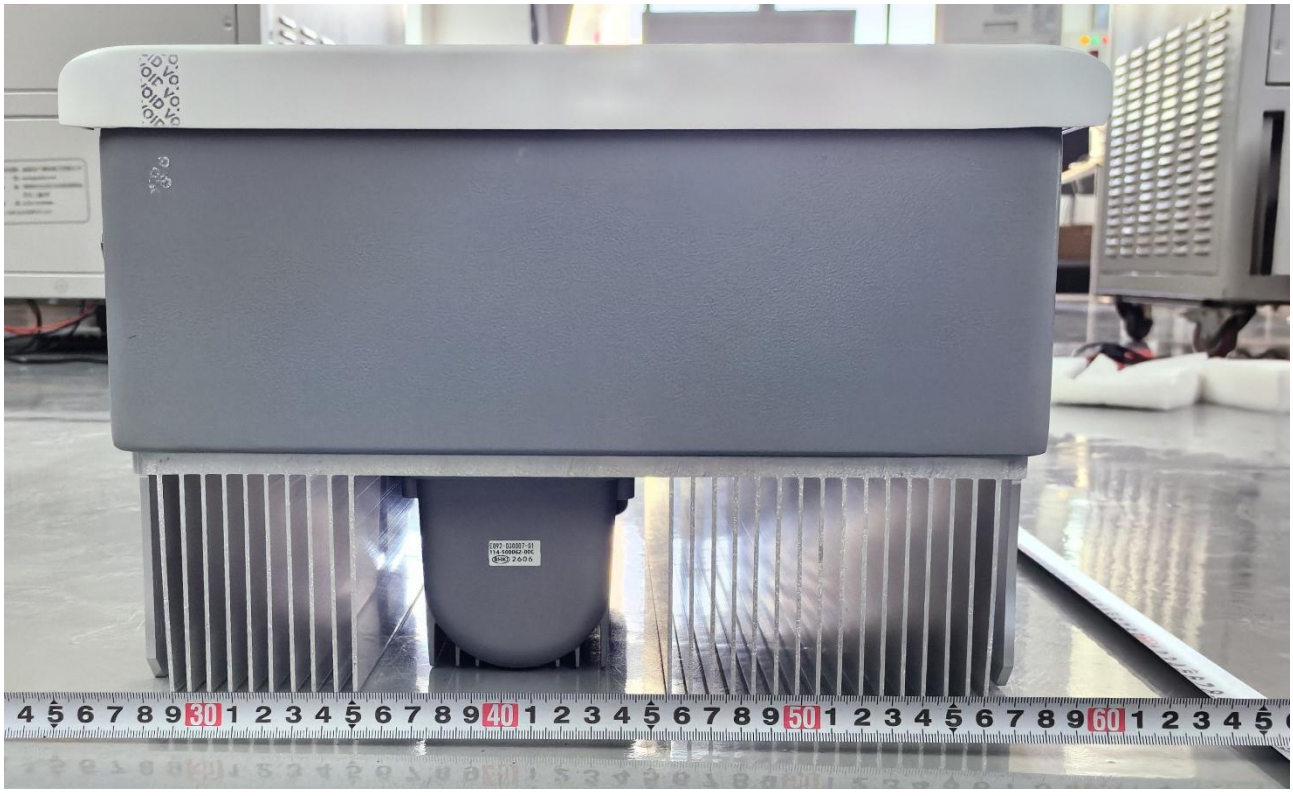
Rated switching voltage (Normally Close) 额定切换电压（常闭触点）	-
Rated current (Normally Open) 额定电流（常开触点）	50A
Rated current (Normally Close) 额定电流（常闭触点）	-
Rated switching power (Normally Open) 额定切换功率（常开触点）	13850VA
Rated switching power (Normally Close) 额定切换功率（常闭触点）	-
Minimum applicable load (Normally Open) 最小使用负载（常开触点）	5VDC 100mA
Minimum applicable load (Normally Close) 最小使用负载（常闭触点）	-
Operate time 吸合时间	≤20ms, excluding bounce time ≤20ms，不含触点抖动时间
Release time 释放时间	≤10ms, excluding bounce time ≤10ms，不含触点抖动时间
Mechanical endurance 机械寿命	100K cycles, 120 cycles/minute
Electrical endurance (Resistive Load) 电气寿命（阻性负载）	43A 1s/9s ON/OFF 30K cycles 线圈通电 1 秒(12V/0.1 秒→下降 5.4~6.6V/0.9S) / 9 秒 OFF 50A 1s/9s ON/OFF 6K cycles 线圈通电 1 秒(12V/0.1 秒→下降 5.4~6.6V/0.9S) / 9 秒 OFF 20A-50A-20A 1s(0.15/0.7/0.15)/9s ON/OFF 30K cycles 线圈通电 1 秒(12V/0.1 秒→下降 5.4~6.6V/0.9S) / 9 秒 OFF
Contact Gap 接点间隙	2.0mm 以上
INSULATION PERFORMANCE 绝缘性能	
Dielectric strength 介电强度	2800VAC 1minute, between open contacts 2800VAC 1 分钟（断开触点间） 4,500VAC 1minute, between coil to contacts 4,500VAC 1 分钟（线圈与触点间）
Impulse withstand voltage 耐浪涌电压	10KV (1.2/50 μs), between coil to contacts 10KV（线圈与触点间）
Insulation resistance 绝缘电阻	1000MΩ at 500VDC, between open contacts and coil to contacts 1000MΩ（断开触点间及线圈与触点间）

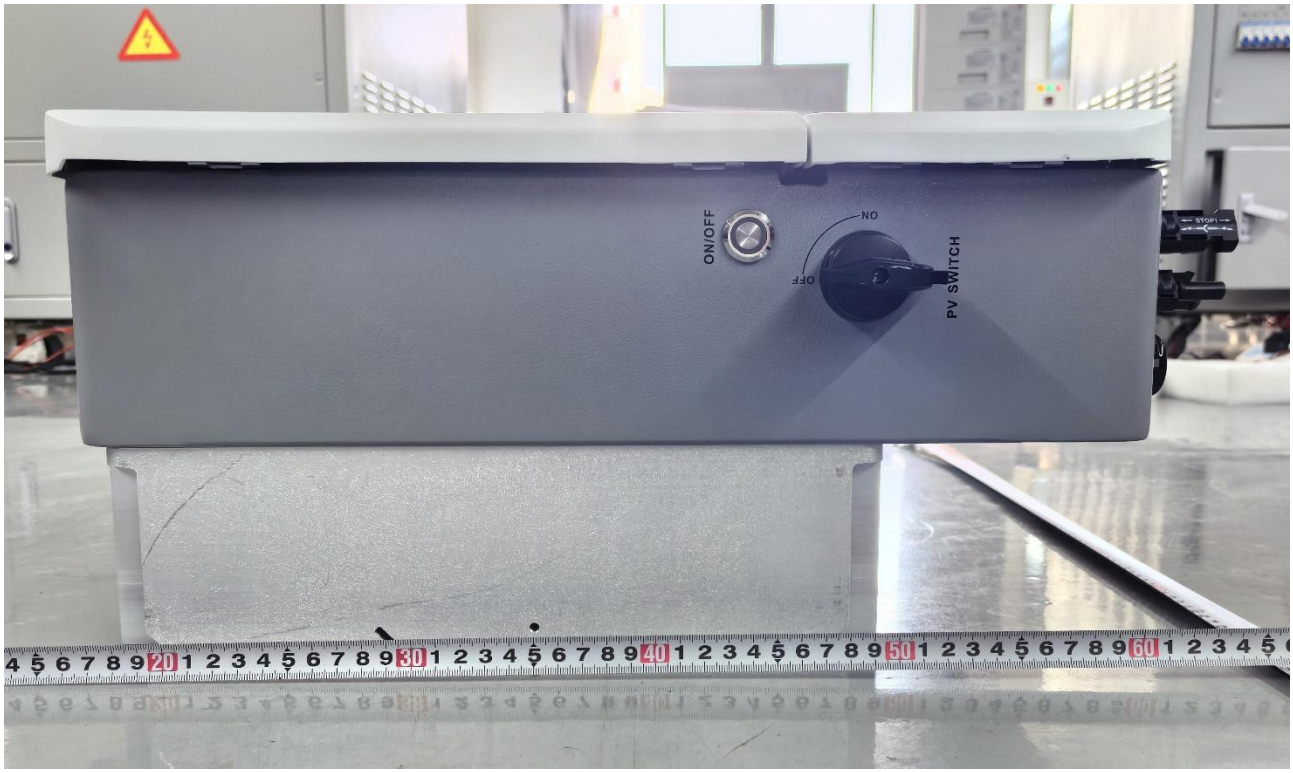
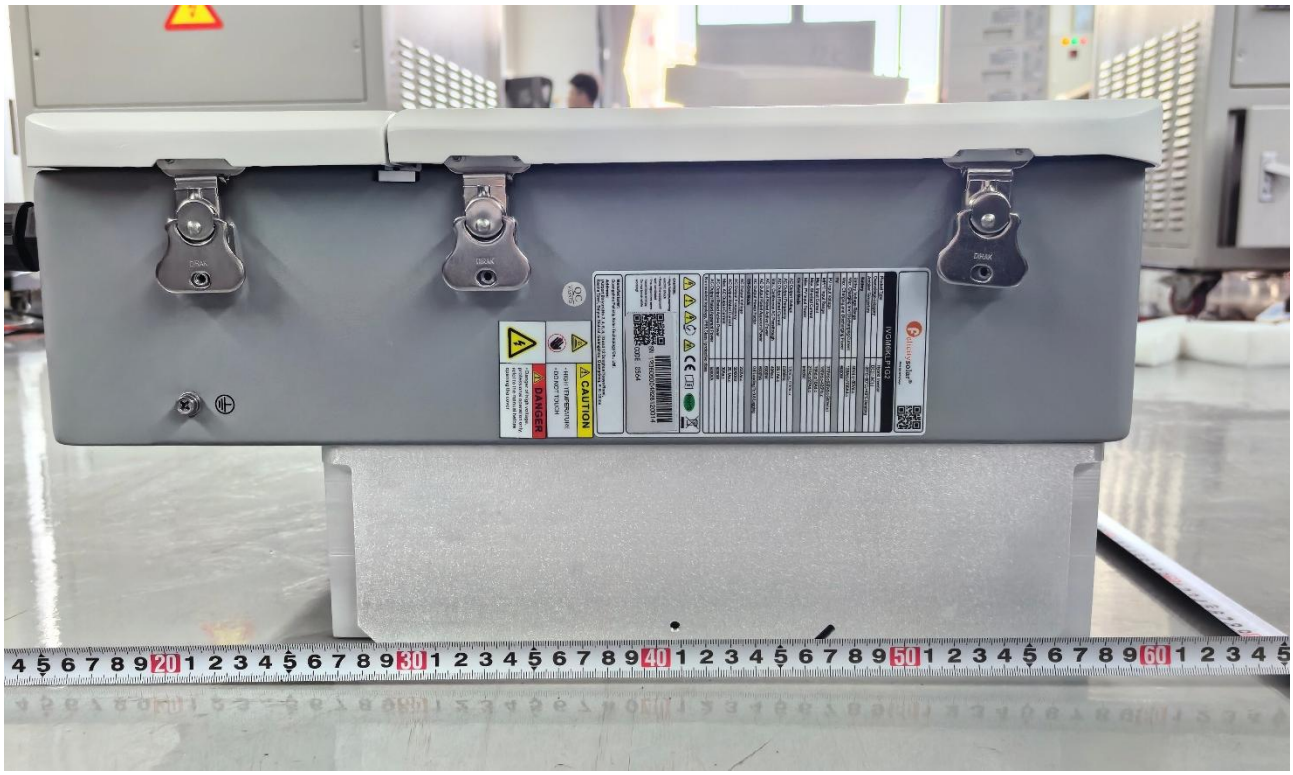
Annex 2
Pictures of the unit

Enclosure front

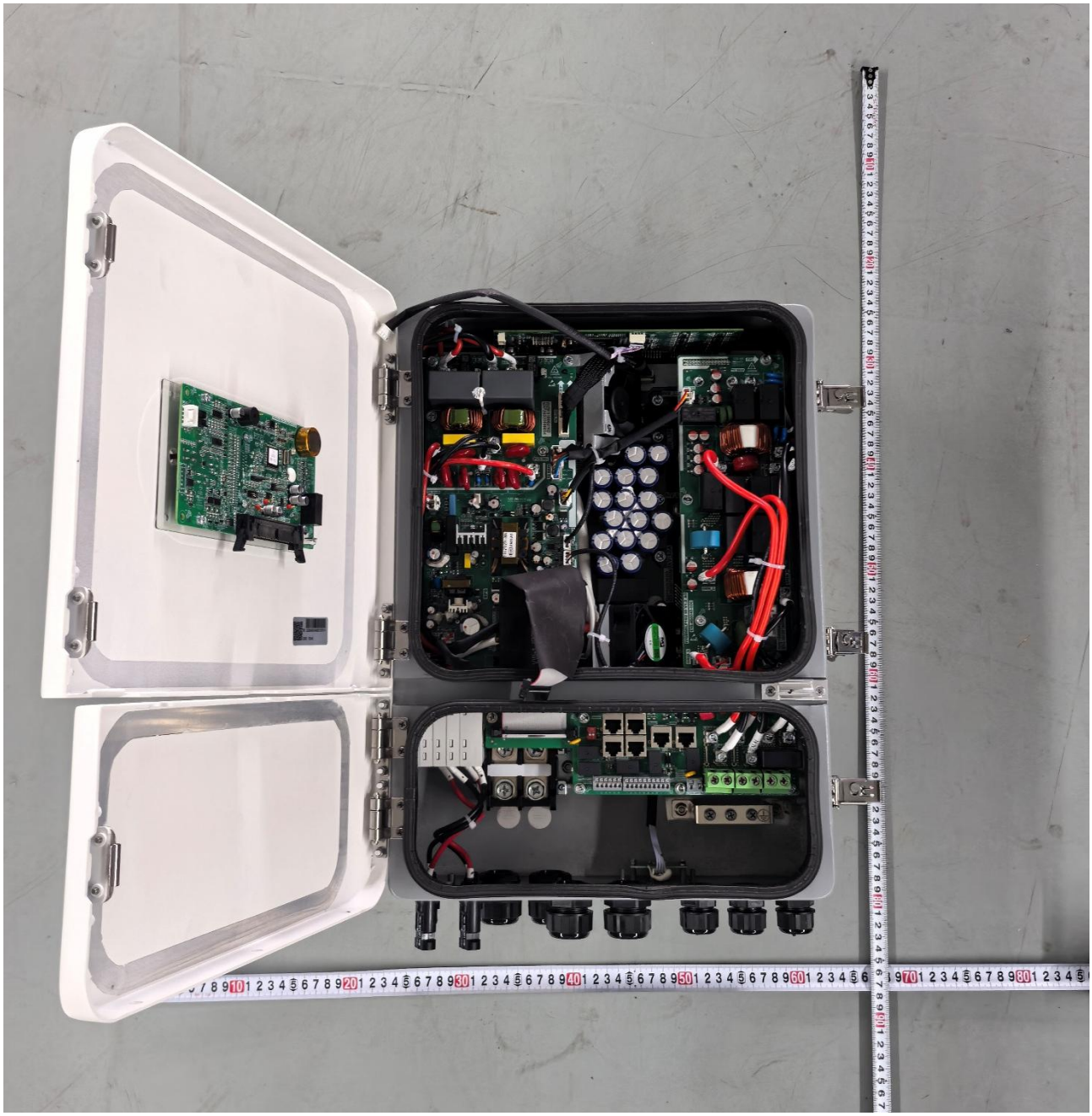

Enclosure back


Enclosure (connectors)

Enclosure top side


Enclosure left side

Enclosure right side


Enclosure open - 1



Annex 3
Test Equipment list

Testing Location: **BUREAU VERITAS LCIE China Company Limited**

Building 4, No, 518, Xinzhuan Road, Caohejing Songjiang High-Tech Park, Shanghai, P,R, China (201612)

Date(s) of performance test: 2026-03-15 to 2026-05-03

No.	Equipment	Internal No.	Type	Manufacturer	Last Calibration	Due Date
1.	Oscilloscope	A4089058SH	ZDS30244Plus	ZLG	05/Jun/25	04/Jun/26
2.	Power Analyzer	A1240096SH	WT3000	YOKOGAWA	06/Aug/25	05/Aug/26
3.	Power Analyzer	A1240144SH	TRIONET3	DEWETRON	06/Jun/25	05/Jun/26
4.	High Voltage probe	A4089059SH	DP6150A	CYBERTEK	05/Jun/25	04/Jun/26
5.	High Voltage probe	A4089060SH	DP6150A	CYBERTEK	05/Jun/25	04/Jun/26
6.	High Voltage probe	A4089063SH	DP6150A	CYBERTEK	05/Jun/25	04/Jun/26
7.	High Voltage probe	A4089066SH	DP6150A	CYBERTEK	05/Jun/25	04/Jun/26
8.	Current probe	A4089061SH	CPL8100A	CYBERTEK	05/Jun/25	04/Jun/26
9.	Current probe	A4089062SH	CPL8100A	CYBERTEK	05/Jun/25	04/Jun/26
10.	Current probe	A4089064SH	CPL2000	CYBERTEK	05/Jun/25	04/Jun/26
11.	Current probe	A4089065SH	CPL2000	CYBERTEK	05/Jun/25	04/Jun/26
12.	Bidirectional AC power source	A7040135SH	AGS-40-7006	ACTION	05/Jun/25	04/Jun/26
13.	Bidirectional DC power source	A7040136SH	ABS-E40-2006	ACTION	05/Jun/25	04/Jun/26
14.	Temperature & humidity meter	B4200078SH	314	center	10/Jun/25	09/Jun/26

END OF TEST REPORT