Test Verification of Conformity

Verification Number: 2401B1675SHA-V1

On the basis of the tests undertaken, the sample<s> of the below product have been found to comply with the requirements of the referenced specification<s>/standard<s> at the time the tests were carried out. This verification is part of the full test report<s> and should be read in conjunction with it <them>.

Applicant Name & Address:	Shenzhen Lvyou Energy Technology Co., Ltd 103-104, Building 12, Dawangshan 2nd Industrial Zone, Shajing, Baoan District, Shenzhen, Guangdong, China
Product Description:	Micro Inverter
Ratings & Principle Characteristics:	See Appendix (Specifications table)
Models/Type References:	See Appendix (Specifications table)
Brand Name:	N/A
Relevant Standards:	VDE-AR-N 4105:2018 conjunction with DIN VDE V 0124-100 :2020
Verification Issuing Office Name & Address:	Intertek Testing Services Shanghai Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China
Date of Tests:	2023-09-04 to 2023-12-30
Test Report Number(s):	2401B1675SHA-001

Additional information in Appendix.

Signature

Name: Max Jin
Position: General Manager
Date: 2024-03-06

APPENDIX: Test Verification of Conformity

This is an Appendix to Test Verification of Conformity Number: 2401B1675SHA-V1

Manufacturer:	Same as applicant

Specifications table	
Model	ES-800
Input:	
Vmax PV (Vdc)	55
Isc PV (absolute Max.) (A)	24
Number MPP trackers	2
Number input strings	2
Max. PV input current(A)	14*2
MPPT voltage range (Vdc)	16 to 55
Output	
Normal Voltage(V)	☒1/N/PE 230Vac ☐3 φ /N/PE 230/400Vac
Frequency (Hz)	☒50 Hz ☒60Hz
Current (Max. continuous) (A)	3.13
Power rating (W)	720
Power Rating (VA)	720
Power factor /rated	≥0.99
others	
Protective class	Class I
Ingress protection (IP)	IP 67
Temperature (°C)	-40° C to +65° C
Inverter Isolation	☐Non-isolated ☒High frequency isolated
Overvoltage category	OVC III (AC Main), OVC II (PV)
Weight (kg)	1.8
Dimensions (WxHxD) (mm)	22.3 x 4.3 x 23

Annex E4: Verification of Conformity for power generation units

Verification of Conformity for power generation units	No.: **2401B1675SHA-V1**	
Manufacturer	Shenzhen Kingsource Technology Co., Ltd. 4F, Building 6, Antuoshan High-tech Industrial Park, Xinsha Road，Shajing Street, Bao'an District, Shenzhen, Guangdong, China	
Type power generation unit	Micro Inverter	
Model		ES-800
Assessment values	Max. active power P_{Emax}	720 W
	Max. apparent power S_{Emax}	720 VA
	Rated voltage	230Vac
Rated values	Rated current (AC) I_r	3.13A
	Initial short-circuit AC current	24A
Network connection rules	**VDE-AR-N 4105 "Power generation systems connected to the low-voltage network"** Technical minimum requirements for connection and parallel operation of power generation systems connected to the low voltage network	
Firmware version	KS-01	

Annex E.5 Test report "Network interactions" for power generation units

Extract from the test report on the certificate of units		2401B1675SHA-001				
Manufacturer:		Shenzhen Kingsource Technology Co., Ltd. 4F, Building 6, Antuoshan High-tech Industrial Park, Xinsha Road，Shajing Street, Bao'an District, Shenzhen, Guangdong, China				
Manufacturer indications:		System type	ES-800			
		Max. active power P_{Emax}	720 W			
		Rated voltage	230Vac			
Measurement period		2023-09-04 to 2023-12-30				
Rapid voltage changes			N/A			
Connection without provisions (regarding the primary energy carrier)			k_i = 0.12			
Most adverse case when switching between generator levels			N/A			
Connection at nominal conditions (of the primary energy carrier)			k_i = 1.00			
Disconnection at rated power			k_i = 0.98			
Worst value of all switching operations			k_{imax} = 1.02			
Flicker	Angle of network impedance Ψ_k:	32°	30°	50°	70°	85°
	Long-term flicker strength P_{lt}:	0.26	N/A	N/A	N/A	N/A
	Initial flicker factor c_Ψ:	N/A	N/A	N/A	N/A	N/A

E.5 Test report "Network interactions" for power generation units

(5.2.4)	TABLE: Harmonics										P	
Harmonics												
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
Order No.	I/In [%]											
2	0.73	0.37	0.35	0.34	0.36	0.37	0.38	0.34	0.41	0.44	0.56	--
3	0.58	0.98	0.36	0.29	0.23	0.21	0.17	0.22	0.19	0.21	0.30	--
4	0.47	0.21	0.19	0.21	0.16	0.15	0.16	0.13	0.12	0.17	0.27	--
5	0.56	1.16	0.69	0.59	0.53	0.51	0.44	0.34	0.32	0.39	0.50	--
6	0.56	0.18	0.03	0.05	0.07	0.07	0.08	0.09	0.09	0.03	0.07	--
7	0.53	0.74	0.56	0.44	0.39	0.38	0.42	0.40	0.36	0.28	0.18	--
8	0.60	0.09	0.03	0.05	0.04	0.02	0.01	0.01	0.04	0.05	0.08	--
9	0.58	0.05	0.40	0.36	0.33	0.28	0.25	0.25	0.25	0.21	0.05	--
10	0.47	0.10	0.09	0.06	0.06	0.03	0.03	0.03	0.22	0.03	0.06	--
11	0.51	0.12	0.25	0.23	0.21	0.20	0.20	0.20	0.17	0.14	0.05	--
12	0.51	0.11	0.04	0.02	0.03	0.03	0.02	0.04	0.29	0.04	0.04	--
13	0.49	0.14	0.03	0.09	0.11	0.10	0.07	0.08	0.08	0.05	0.03	--
14	0.49	0.08	0.06	0.07	0.05	0.02	0.01	0.01	0.02	0.04	0.04	--
15	0.47	0.20	0.02	0.05	0.05	0.07	0.08	0.06	0.05	0.02	0.03	--
16	0.40	0.07	0.06	0.03	0.02	0.02	0.03	0.03	0.01	0.03	0.04	--
17	0.38	0.07	0.09	0.04	0.02	0.01	0.02	0.03	0.05	0.05	0.04	--
18	0.47	0.09	0.04	0.02	0.03	0.02	0.02	0.03	0.04	0.02	0.02	--
19	0.44	0.20	0.07	0.03	0.02	0.03	0.03	0.04	0.04	0.05	0.03	--
20	0.42	0.09	0.07	0.03	0.01	0.02	0.02	0.01	0.03	0.02	0.02	--
21	0.38	0.05	0.05	0.07	0.05	0.04	0.03	0.03	0.06	0.05	0.02	--
22	0.40	0.03	0.08	0.04	0.02	0.03	0.03	0.03	0.04	0.05	0.01	--
23	0.38	0.16	0.08	0.06	0.04	0.04	0.05	0.07	0.09	0.08	0.03	--
24	0.36	0.08	0.02	0.04	0.02	0.01	0.01	0.01	0.03	0.03	0.02	--
25	0.36	0.13	0.05	0.06	0.07	0.07	0.08	0.09	0.11	0.11	0.02	--
26	0.33	0.12	0.04	0.07	0.04	0.04	0.05	0.04	0.02	0.03	0.01	--
27	0.29	0.21	0.08	0.07	0.06	0.07	0.08	0.10	0.11	0.10	0.02	--
28	0.31	0.11	0.03	0.03	0.03	0.02	0.01	0.02	0.01	0.02	0.02	--
29	0.29	0.17	0.09	0.08	0.09	0.08	0.09	0.11	0.10	0.07	0.02	--
30	0.33	0.04	0.01	0.04	0.05	0.04	0.04	0.03	0.01	0.01	0.01	--
31	0.31	0.22	0.13	0.09	0.07	0.08	0.09	0.09	0.10	0.07	0.02	--
32	0.29	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.01	0.02	0.02	--
33	0.27	0.20	0.11	0.07	0.06	0.06	0.07	0.09	0.07	0.06	0.02	--
34	0.29	0.12	0.04	0.01	0.04	0.03	0.03	0.03	0.02	0.01	0.02	--
35	0.18	0.18	0.11	0.05	0.03	0.03	0.03	0.05	0.04	0.05	0.02	--
36	0.18	0.06	0.03	0.04	0.02	0.01	0.01	0.02	0.02	0.02	0.02	--
37	0.24	0.18	0.10	0.03	0.01	0.01	0.01	0.01	0.02	0.02	0.02	--
38	0.20	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.03	0.04	0.01	--
39	0.22	0.14	0.08	0.03	0.03	0.02	0.03	0.02	0.02	0.01	0.02	--
40	0.18	0.07	0.04	0.04	0.04	0.03	0.01	0.00	0.02	0.02	0.01	--

(5.2.4)	TABLE: Harmonic current limit test (EN 61000-3-2)						P
Model							
Harmonic	L1		--		--		Limits -A
	Magnitude (A)	% of I	Magnitude (A)	% of I	Magnitude (A)	% of I	
02	0.17	--	--	--	--	--	1.08
03	0.09	--	--	--	--	--	2.30
04	0.08	--	--	--	--	--	0.43
05	0.15	--	--	--	--	--	1.14
06	0.02	--	--	--	--	--	0.30
07	0.05	--	--	--	--	--	0.77
08	0.02	--	--	--	--	--	0.23
09	0.01	--	--	--	--	--	0.40
10	0.01	--	--	--	--	--	0.18
11	0.01	--	--	--	--	--	0.33
12	0.01	--	--	--	--	--	0.15
13	0.01	--	--	--	--	--	0.21
14	0.01	--	--	--	--	--	0.13
15	0.01	--	--	--	--	--	0.15
16	0.01	--	--	--	--	--	0.12
17	0.01	--	--	--	--	--	0.13
18	0.00	--	--	--	--	--	0.10
19	0.00	--	--	--	--	--	0.12
20	0.00	--	--	--	--	--	0.09
21	0.01	--	--	--	--	--	0.11
22	0.00	--	--	--	--	--	0.08
23	0.01	--	--	--	--	--	0.10
24	0.00	--	--	--	--	--	0.08
25	0.00	--	--	--	--	--	0.09
26	0.00	--	--	--	--	--	0.07
27	0.00	--	--	--	--	--	0.08
28	0.00	--	--	--	--	--	0.07
29	0.00	--	--	--	--	--	0.08
30	0.00	--	--	--	--	--	0.06
31	0.00	--	--	--	--	--	0.07
32	0.00	--	--	--	--	--	0.06
33	0.00	--	--	--	--	--	0.07
34	0.00	--	--	--	--	--	0.05
35	0.00	--	--	--	--	--	0.06
36	0.00	--	--	--	--	--	0.05
37	0.00	--	--	--	--	--	0.06
38	0.00	--	--	--	--	--	0.05
39	0.00	--	--	--	--	--	0.06
40	0.00	--	--	--	--	--	0.05
THD	--	4.97	--	--	--	--	--

Annex E.7 Requirements to the Test Report on the NS protection

Extract from the test report for the NS protection "Determination of electric properties"		2401B1675SHA-001
Test report NS Protection		
Type of NS protection:	Integrated NS protection	Further manufacturer indications
Software version:	KS-01	
Manufacturer:	Shenzhen Kingsource Technology Co., Ltd.	
Measurement period:	2023-09-04 to 2023-12-30	

	Inverter(s)		
Protective function	Set value	Tripping value	Tripping value NS protection
Rise-in-voltage protection U >>	1.25 * U_n	1.252 Un	291ms
Rise-in-voltage protection U >	1.10 * U_n	1.100 Un	536 s
Voltage drop protection U <	0.8 * U_n	0.800 Un	186ms
Voltage drop protection U <	0.45 * Un	0.448 Un	373 ms
Frequency decrease protection f <	47.5Hz	47.50 Hz	47 ms
Frequency increase protection f >	51.5Hz	51.50 Hz	51 ms

[a] The tripping time includes the period from the limit value violation U/f until the tripping signal to the interface switch.
When planning the power generation system, the response time of the interface switch shall be added to the maximum time value obtained as indicated above.
The disconnection time (sum of tripping time of the NS protection plus response time of the interface switch) shall not exceed 200 ms
* Longest disconnection of the rise-in-voltage protection as a moving 10-minute-average.

☒ **For integrated NS protection**	
Assigned to power generation unit of type	ES-800
Type integrated interface switch	(Hongfa) HF115F
Response time of interface switch for integrated NS protection	20ms
Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.	
NOTE1: Un=230V	

Remark:

The sample<s> covered in this VOC are incomplete in functional features or limited in performance capabilities and are intended for use and evaluation in other products. See test report for detail information.

Signature

Name: Max Jin
Position: General Manager
Date: 2024-03-06

TEST REPORT VDE-AR-N 4105 Power generation systems connected to the low-voltage distribution network		
Report Reference No.:	2401B1675SHA -001	
Tested by (name + signature):	Butch Zang	
Approved by (name + signature):	Kevin Zhu	
Date of issue :	2024-03-06	
Contents:	26 pages	
Testing Laboratory:	**Intertek Testing Services Shanghai.**	
Address:	Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China.	
Testing location / procedure:	**TL** ☒ **SMT** ☐ **TMP** ☐	
Testing location / address:	Same as above	
Applicant's name:	Shenzhen Lvyou Energy Technology Co., Ltd	
Address:	103-104, Building 12, Dawangshan 2nd Industrial Zone, Shajing, Baoan District, Shenzhen, Guangdong, China	
Test specification:		
Standard:	VDE-AR-N 4105:2018 conjunction with DIN VDE V 0124-100:2020	
Test procedure:	Type Test	
Non-standard test method:	N/A	
Test Report Form/blank test report		
Test Report Form No. :	VDE_4105_TTRF_V1.0	
TRF Originator :	Intertek Shanghai	
Master TRF :	2020-06	
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Test item description:	Micro Grid-tied Inverter
Trade Mark:	N/A
Manufacturer:	Same as applicant
Model/Type reference:	ES-800
Rating:	See below Specifications table

Specifications table	
Model	ES-800
Input:	
Vmax PV (Vdc)	55
Isc PV (absolute Max.) (A)	24
Number MPPT trackers	2
Number input strings	2
Max. PV input current(A)	14*2
MPPT voltage range (Vdc)	16 to 55
Output	
Normal Voltage(V)	☒1/N/PE 230Vac ☐3 ϕ /N/PE 230/400Vac
Frequency (Hz)	☒50 Hz ☐60Hz
Current (Max. continuous) (A)	3.13
Power rating (W)	720
Power Rating (VA)	720
Power factor /rated	≥0.99
others	
Protective class	Class I
Ingress protection (IP)	IP 67
Temperature (°C)	-40°C to +65°C
Inverter Isolation	☐Non-isolated ☒High frequency isolated
Overvoltage category	OVC III (AC Main), OVC II (PV)
Weight (kg)	1.8
Dimensions (WxHxD) (cm)	22.3 x 4.3 x 23

Test item particulars	
PGU connect to Grid System	☒ 1/N/PE ☐ 3/PE ☐ 3/N/PE
PGS(kVA)	☒≤3.68 ☐ ≤13.8 ☐ >13.8
Default cos φ- reactive power adjusted	☒ a fixed displacement factor, cos φ=1 ☐ Standard characteristic curve for cos φ (*P*) ☐ non-Standard characteristic curve for cos φ (*P*)
Function of cos φ/Q- reactive power adjusted	☒ Not adjusted ☐ a fixed displacement factor cos φ. ☐ Characteristic curve for cos φ (*P*) ☐ Characteristic curve for Q(U) ☐ Dynamic network supporting (FVRT)
Function of active power adjusted	☒ Active power reduction ☐ Active power output by over-frequency ☐ Active power output by under-frequency ☐ $P_{AV,E}$ monitoring
NS protection	☐ Central NS protection ☒ Integrated NS protection
Voltage –Line to line	☐ Arithmetically from the three line-to-neutral voltages ☒ Measured separately. ☒ N/A
IP protection class :	IP65
Remark PGS: Power Generation System, PGU: Power Generation unit.	
Possible test case verdicts:	
- test case does not apply to the test object:	N/A
- test object does meet the requirement:	P(Pass)
- test object does not meet the requirement:	F(Fail)
Testing:	
Date of receipt of test item :	2023-09-26
Date (s) of performance of tests :	2023-09-27 to 2023-12-28

General remarks:

The test results presented in this report relate only to the object (single PV inverter unit) tested. The testing voltage is 230Vac single phase. The information about Generating Plant is not considered and tested.

Installer and relevant persons shall comply with VDE-AR-N4105 and relevant standard and Grid Code in this standard.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

"(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 point is used as the decimal separator.

Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods.

Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

The test results presented in this report relate only to the item tested. See general product information next for details information.

The test does not include the faults inside the CPU and software evaluation as agreed with client.

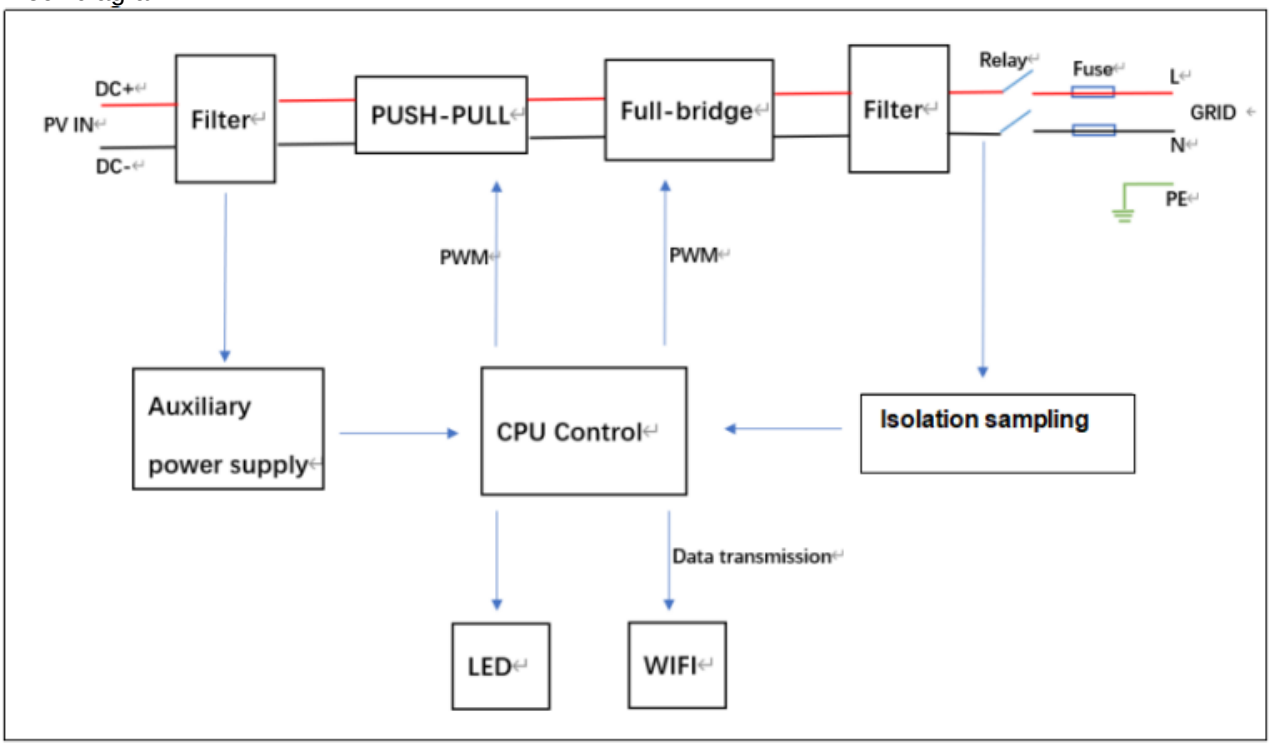
All the tests are performed on a single unit.

The clause number in first is about VDE-AR-N 4105 The clause number in bracket is about DIN V VDE V 0124-100

General product information:

1. The Hybrid inverter is isolated (transformer) inverter which works convert PV to the grid and load, it intends to be connected into household generation systems and utilizes solar power, utility power and battery power to ensure continuous power supply.
2. In order to protect the inverter, user and installer, external DC and AC circuit breaker shall be equipped for all source port (battery. AC grid) at the end-use application.
3. If certain functions are not permitted by local regulation, the function shall be disabled by hardware or software setting (if applicable) by the manufacturer before putting into the market. For example, it's not permissible to draw electricity from the grid and then feed it back in order to claim statutory reimbursement in some nations.
4. Low voltage electrical installations shall comply with national and local regulations. Only qualified electricians are allowed to install and maintain the converter.

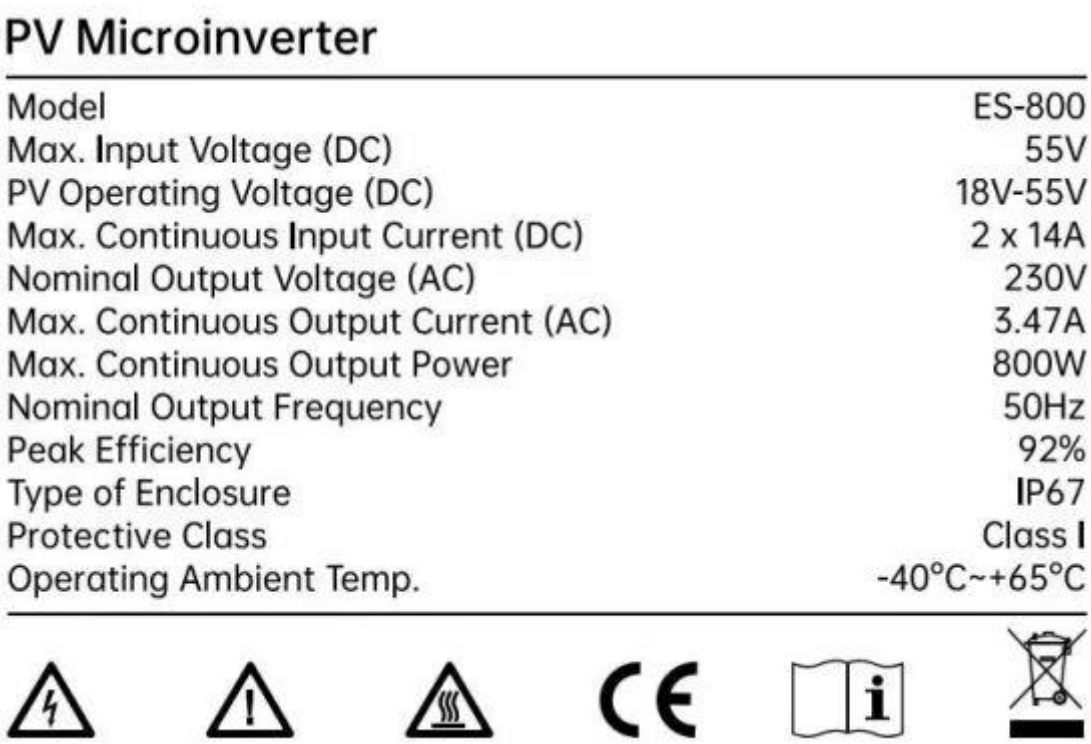
Block diagram:



Version Number:
Software versioning: KS-01
Hardware version number: 0900302

Abbreviations used in the report:
PGU: Power Generation unit.
PGS: Power Generation System
In: Rated current of power generation unit.

Copy of marking plate:



VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
4	General framework conditions		--
4.1	Provisions and regulations	NA for PGU testing	N/A
4.2	Application procedure and connection relevant documents	NA for PGU testing	N/A
4.3	Initial start-up of the power generation system	NA for PGU testing	N/A
5	Network connection		--
5.1	Principles for determination of the network connection point	NA for PGU testing	N/A
5.2	Rating of the network equipment	NA for PGU testing	N/A
5.3	Permissible voltage change	NA for PGU testing	N/A
5.4	Network interactions		N/A
5.5	Connection criteria		--
5.5.1	General		P
	When connecting a power generation system or a storage unit, the technical connection conditions of the network operator shall be observed.	Shall be considered full feed-in that in accordance with VDE-AR-N 4100 in the power system	P
5.5.2	PAV, E monitoring (feed-in limitation)	The independent equipment shall be installed at end use.	N/A
5.5.3	Power generation systems ready for connection		N/A
5.6	Three-phase inverter systems	No Three-phase inverter system will be combined.	N/A
5.7	Behaviour of the power generation system at the network		P
5.7.1	General		P
	For frequencies between 47,5 Hz and 51,5 Hz, automatic disconnection from the network due to a frequency deviation is not permitted. The actual operating principle and the associated exceptions are detailed in 5.7.4.3. Frequency-dependent active power control is implemented in the open-loop control of the power generation units.		P
5.7.2	Steady-state voltage stability/reactive power supply	No such function, the independent equipment shall be installed at end use.	N/A
5.7.2.1	General boundary conditions		N/A
5.7.2.2	Reactive power supply at ΣSEmax		N/A
5.7.2.2.1	General		N/A
	It is permissible in certain cases described in 5.7.2.2.2 and 5.7.3 to reduce the active power supply to the benefit of the reactive power supply. This is not considered a reduction of the active power supply in the context of network security management. Power generation systems shall comply with the reactive power supply irrespective of the number of feed-inphases under normal operating conditions in the voltage tolerance band Un ± 10 %.		N/A
5.7.2.2.2	Type 2 systems – inverters only		N/A
5.7.2.2.3	Type 2 systems – Asynchronous generators (directly connected to the network and principally not able to control any reactive power)	Inverter only	N/A
5.7.2.2.4	Type 1 systems and type 2 systems – stirling generators and fuel cells	Inverter only	N/A

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
5.7.2.3	Reactive power supply smaller than PEmax	No such function, the independent equipment shall be installed at end use.	N/A
5.7.2.4	Methods for reactive power supply	No such function, the independent equipment shall be installed at end use.	N/A
	a) reactive power voltage characteristic curve Q(U); or		N/A
	b) displacement factor/active power characteristic curve cos ϕ (P); or		N/A
	c) fixed displacement factor cos ϕ.		N/A
	The Q(U) rule applies only to three-phase power generation units connected to the three-phase current system.		N/A
5.7.2.5	Requirements for reactive power methods of type 2 systems (inverters only) and type 1 systems	No such function, the independent equipment shall be installed at end use.	N/A
	In the delivery state, none of the three reactive power methods specified in 5.7.2.4 is set as default. During the commissioning of power generation units, the method specified by the network operator shall be set by the system installer. Without the setting of the method specified by the network operator, power generation units shall not feed in any power.		N/A
5.7.2.6	Special aspects regarding the extension of power generation systems	No such function, the independent equipment shall be installed at end use.	N/A
5.7.3	Dynamic network stability	No such function, the independent equipment shall be installed at end use.	N/A
5.7.3.1	General		N/A
5.7.3.2	Dynamic network stability for type 1 units Transient stability – Reaction to network faults		N/A
5.7.3.3	Dynamic network stability for type 2 units and storage units	No such function, the independent equipment shall be installed at end use.	N/A
	The following conditions apply to all type 2 power generation units and storage units: As long as the line-neutral-voltages at the generator terminals of the power generation unit or storage unit do not exceed the limit curves shown in Figure 12 (red for the under-voltage limit curve, blue for the over-voltage limit curve), both the power generation unit and the storage unit shall neither become unstable nor disconnect from the network throughout the operating range.		N/A

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
	For evaluating the curves, the smallest respective value of the line-neutral-voltages at the power generation unit or the storage unit shall be used in case of a voltage drop, and the highest respective value of the line-neutral- voltages at the power generation unit or the storage unit shall be used in case of a voltage rise. As far as the set values for the NS protection given in Table 2 (column “Inverter(s)”) anticipate the requirements given in Figure 12 in certain working points, merely the checking of the set values for NS protection is required for the verification procedure.		N/A
	If the voltage at the generator terminals falls below < 0,8 Un or exceeds > 1,15 Un (onset of fault), type 2 power generation units and storage units shall ride through voltage drops without feeding current into the network of the network operator (limited dynamic network stability).		N/A
	This requirement is deemed to be met, if the current fed in by the power generation unit(s) and/or the storage unit in any line conductor does not exceed 20 % of the rated current Ir within 60 ms and 10 % of Ir within 100 ms upon a voltage drop below 0,8 Un or a voltage rise above 1,15 Un.		N/A
	Behaviour after the end of a fault. If, after the end of a fault, the network voltage resumes a value within the voltage band from –15 % Un to +10 % Un and the active current of the power generation unit and/or the storage unit has been reduced during the network fault, it shall, immediately after the end of the fault, be increased to its pre-fault value as quickly as possible. The transient period shall not exceed a maximum of 1 s. The reactive power supply follows 5.7.2.5 in its time-related behaviour. In case of rotating machinery, the transient period shall not exceed a maximum of 6 s. At voltages of 1,15 Un, the power generation units and storage units shall not disconnect from the network for a period of up to 60 s after the onset of the fault. If the tripping of the self-protection of the power generation units and/or the storage unit is imminent, these units can adjust their reactive power behaviour such as to prevent self-protection tripping.		N/A
5.7.4	Active power output		P
5.7.4.1	General		P
	In cases where set-points are specified by a third party (e. g. direct marketing) and of network security management in accordance with 5.7.4.2, the new set-point shall be approached with the customer installation’s power gradients listed below in relation to the network connection point. Implementation of those power gradients directly at the power generation units or storage units is sufficient for meeting the requirement.	The active power can be remote-controlled on the communication interface	P
5.7.4.2	Network security management		P
5.7.4.2.1	Types of power generation systems and storage units	The active power can be remotly controlled on the communication interface	P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
	Photovoltaic systems		P
	Cogeneration of power and heat (CHP) systems, wind, biogas, hydroelectric power as well as landfill and sewage gas systems		N/A
	Storage units buffering EEG or KWKG systems		N/A
	Any EEG and KWKG systems with an intelligent measurement system		N/A
	Any power generation systems and storage units other than those indicated above		N/A
5.7.4.2.2	Implementation of network security management	No such function, the independent equipment shall be installed at end use.	N/A
5.7.4.2.3	Active power adjustment at over-frequency and under-frequency	No such function, the independent equipment shall be installed at end use.	N/A
5.7.4.4	Voltage-dependent active power reduction	No such function, the independent equipment shall be installed at end use.	N/A
5.7.5	Short-circuit contribution Due to the operation of a power generation system, the short-circuit current of the low-voltage network is increased by the short-circuit current of the power generation system. Therefore, the short-circuit current of the power generation system to be expected at the network connection point shall be indicated in accordance with 4.2. For the determination of the initial short-circuit AC current contribution IkA of a power generation system, the following roughly estimated values can be assumed: – for synchronous generators: 8 times the rated current; – for asynchronous generators: 6 times the rated current; – for generators and storage units with inverters: the rated current. If the power generation system causes a short-circuit current increase in the network operator's network in excess of the rated value, then connection owner and network operator shall agree upon appropriate measures limiting the short-circuit current from the power generation system accordingly.		P
6	Construction of the power generation system/network and system protection (NS protection)		--
6.1	General requirements		N/A
	The network and system protection (NS protection) is a type-tested protective device with a NS protection certificate (see Form E.6) wherein all protective functions specified in 6.5 are installed. The NS protection acts on the interface switch in accordance with 6.4. Depending on the sum of the maximum apparent powers of all power generation systems and storage units connected to the same network connection point ΣSAmax, the following conditions apply to the NS protection:		P
6.2	Central NS protection		N/A
6.3	Integrated NS protection	integrated NS protection	P
6.4	Interface switch		P
6.4.1	General		P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
	For the connection of the power generation system to the network operator's low-voltage network or to the remaining customer installation, an interface switch shall be used. The interface switch is controlled by the NS protection and automatically triggers if at least one protective function responds.		P
	The functional check of the interface switch shall be carried out according to a) or b) or c): a) by using an interface switch which, in its active state, requires a control voltage to be applied continuously and which disconnects automatically when this voltage is no longer applied. The operational connection and disconnection processes shall be monitored; b) by connection and disconnection of the interface switch via the NS protection and monitoring its proper functioning (e. g. break contact of a monitoring contact) at least once daily; c) by using the integrated interface switch and the integrated NS protection for PV and battery inverters in compliance		P
6.4.2	Central interface switch		N/A
6.4.3	Integrated interface switch		N/A
	In the case of integrated NS protection, the NS protection can be integrated in the programmable system control of the power generation units (e.g. in the inverter control). If so, then both the test button and the sealing may be omitted, however, password protection is required, if the protective function U > is adjustable. The integrated NS protection acts on an integrated interface switch (see 6.4.3).		N/A
6.5	Protective devices and protection settings		P
6.5.1	General		P
	The purpose of NS protection is to disconnect the power generation system from the network in the event of inadmissible voltage and frequency values (also refer to DIN VDE 0100-551 (VDE 0100-551)). This is meant to prevent inadvertent feed-in from the power generation system into a partial network separated from the main distribution network.		P
6.5.2	Protective functions		P
	The NS protection shall be provided with a means for preventing unauthorised access (z. B. sealable, password protection). The rise-in-voltage protection U > shall be designed such as to be adjustable in the NS protection (see Table 2, Footnote b). Additionally, the time delay of the voltage drop protection U < and U << for directly coupled synchronous and asynchronous generators with Pn > 50 kW shall also be designed such as to be adjustable in the NS protection (see Table 2, Footnote d). Any other protective functions listed in 6.5.1 are either to be installed permanently, i. e. not adjustable, in the NS protection or to be provided with an additional separate protection against unauthorised access (e. g. password protection) for preventing modifications.		P
6.5.3	Islanding detection	(See appended table)	P
6.6	Further requirements for power generation systems	Shall be considered in PGS	NA
7	Metering for billing purposes		NA
8	Operation of the system		P

VDE-AR-N 4105			
Clause	Requirement - Test	Result - Remark	Verdict
8.1	General		P
8.2	Special aspects of the management of the network operator's network		NA
8.3	Connection conditions and synchronisation		P
8.3.1	General		P
	Power generation systems and storage units shall be connected to the network operator's network only if a suitable device determines that both the mains voltage and the mains frequency are within the tolerance range of 85 % Un to 110 % Un or 47,5 Hz to 50,1 Hz, respectively, for a period of at least 60 seconds. Additionally, the delay times for the reconnection of a generator and the staggered times applicable when connecting several generators shall be sufficient for safely finishing any control and adjustment processes within the power generation system and/or the storage unit caused by the connection. In case of power generation systems and storage units being reconnected to the network operator's network at the tripping of the NS protective device or the PAV, E monitoring, the active power of controllable power generation systems and storage units supplied to the network operator's network shall not exceed the gradient of 10 % of the active power PAmax per minute. Non-controllable power generation systems and storage units can connect after 1 min to 10 min (random generator) or later.	(See appended table)	P
8.3.2	Connection of synchronous generators		N/A
8.3.3	Connection of asynchronous generators		N/A
8.3.4	Connection of power generation units and storage units with inverters Power generation units with inverters (such as photovoltaic systems) and storage units with inverters shall only be connected with kimax ≤ 1,2.		P
8.4	Special aspects regarding the planning, installation and operation of power generation systems and storage units each with PAmax ≥ 135 kW		NA
9	Verification of electrical properties		P
	Annex A: Explanations (informative)		---
	Annex B: Connection examples and measurement strategies (informative)		---
	Annex C: Examples of meter panel configurations (informative)		---
	Annex D: Examples for the connection evaluation of power generation systems -Connection of a 20 kW PV system (informative)		---

DIN VDE V 0124-100			
Clause	Requirement - Test	Result - Remark	Verdict
5.2.2	Rapid voltage change (Kimax)		P
5.2.3	Flicker		P
5.2.4	Harmonics and Inter-harmonics (I inter, I higher)		P
5.2.5	Commutation notches		N/A
5.2.6	DC current feeding to network (Idc)		P
5.3.2	Tests of three-phase inverter (Imbalance)		N/A
5.3.3	Symmetry operation with a symmetry device		N/A
5.4.2	Measurement of active- and reactive power ranges (P&Q range)		N/A
5.4.3	Active power reduction through setting provision (P control)		P
5.4.4	Active power output of PGU by over-frequency (LFSM-O)		N/A
5.4.5	Active power output of ESS by over-frequency (LFSM-O)		N/A
5.4.6	Active power output of PGU by under-frequency (LFSM-U)		N/A
5.4.7	Active power output of ESS by under-frequency (LFSM-U)		N/A
5.4.8.2	Tests of reactive power / displacement factor setting accuracy (Fixed cosφ)		N/A
5.4.8.3	Tests of displacement factor- / active power character curve (cosφ (P))		N/A
5.4.8.4	Tests of reactive power-voltage character curve (Q(U))		N/A
5.5.2	NS-protection		N/A
5.5.3	Central NS-protecton		N/A
5.5.4	Integrated NS-protection		N/A
5.5.6	Interface switch (Functional safety)		P
5.5.7	Protection devices and protection settings (OV/UV, OF/UF)		P
5.5.9	Constructional features of NS protection		P
5.5.10	Islanding detection		P
5.6	Connection conditions and synchronization (Reconnection)		P
5.7	Verification of $P_{AV,E}$ monitoring		N/A
5.8	Verification of dynamic network supporting (FVRT)		N/A

Appendix table1

8.3.4 (5.2.2)	TABLE: Rapid voltage change (Kimax)			P
Test Conditions	Measurements			Limit
	U/Un	I/In	Ki	Ki
Starting to 50%Pn	1.00	0.36	0.12	≤ 1.2
Starting to 100% Pn	1.00	3.14	1.00	≤ 1.2
Stopping at 100% Pn	1.00	3.08	0.98	≤ 1.2
Note(s):				

(5.2.3)	TABLE: Flicker			P
Measurement	Plt	0.11		
	Limit	0.65		
	Pst	dc[%]	dmax[%]	d(t)[ms]
	1.0	3.3	4.0	500
1	0.084	0.096	0.178	0.0
2	0.120	0.127	0.280	0.0
3	0.129	0.187	0.260	0.0
4	0.136	0.151	0.399	0.0
5	0.080	0.136	0.170	0.0
6	0.080	0.111	0.172	0.0
7	0.080	0.108	0.180	0.0
8	0.081	0.098	0.148	0.0
9	0.082	0.109	0.164	0.0
10	0.130	0.159	0.350	0.0
11	0.125	0.082	0.245	0.0
12	0.129	0.104	0.222	0.0
Note(s): PGU and ESS with nominal current ≤75A (Per DIN EN 61000-3-3)				

(5.2.4)	TABLE: Harmonics										P	
Harmonics												
P/P_n [%]	0	10	20	30	40	50	60	70	80	90	100	Limit
Order No.	I/In [%]											
2	0.73	0.37	0.35	0.34	0.36	0.37	0.38	0.34	0.41	0.44	0.56	--
3	0.58	0.98	0.36	0.29	0.23	0.21	0.17	0.22	0.19	0.21	0.30	--
4	0.47	0.21	0.19	0.21	0.16	0.15	0.16	0.13	0.12	0.17	0.27	--
5	0.56	1.16	0.69	0.59	0.53	0.51	0.44	0.34	0.32	0.39	0.50	--
6	0.56	0.18	0.03	0.05	0.07	0.07	0.08	0.09	0.09	0.03	0.07	--
7	0.53	0.74	0.56	0.44	0.39	0.38	0.42	0.40	0.36	0.28	0.18	--
8	0.60	0.09	0.03	0.05	0.04	0.02	0.01	0.01	0.04	0.05	0.08	--
9	0.58	0.05	0.40	0.36	0.33	0.28	0.25	0.25	0.25	0.21	0.05	--
10	0.47	0.10	0.09	0.06	0.06	0.03	0.03	0.03	0.22	0.03	0.06	--
11	0.51	0.12	0.25	0.23	0.21	0.20	0.20	0.20	0.17	0.14	0.05	--
12	0.51	0.11	0.04	0.02	0.03	0.03	0.02	0.04	0.29	0.04	0.04	--
13	0.49	0.14	0.03	0.09	0.11	0.10	0.07	0.08	0.08	0.05	0.03	--
14	0.49	0.08	0.06	0.07	0.05	0.02	0.01	0.01	0.02	0.04	0.04	--
15	0.47	0.20	0.02	0.05	0.05	0.07	0.08	0.06	0.05	0.02	0.03	--
16	0.40	0.07	0.06	0.03	0.02	0.02	0.03	0.03	0.01	0.03	0.04	--
17	0.38	0.07	0.09	0.04	0.02	0.01	0.02	0.03	0.05	0.05	0.04	--
18	0.47	0.09	0.04	0.02	0.03	0.02	0.02	0.03	0.04	0.02	0.02	--
19	0.44	0.20	0.07	0.03	0.02	0.03	0.03	0.04	0.04	0.05	0.03	--
20	0.42	0.09	0.07	0.03	0.01	0.02	0.02	0.01	0.03	0.02	0.02	--
21	0.38	0.05	0.05	0.07	0.05	0.04	0.03	0.03	0.06	0.05	0.02	--
22	0.40	0.03	0.08	0.04	0.02	0.03	0.03	0.03	0.04	0.05	0.01	--
23	0.38	0.16	0.08	0.06	0.04	0.04	0.05	0.07	0.09	0.08	0.03	--
24	0.36	0.08	0.02	0.04	0.02	0.01	0.01	0.01	0.03	0.03	0.02	--
25	0.36	0.13	0.05	0.06	0.07	0.07	0.08	0.09	0.11	0.11	0.02	--
26	0.33	0.12	0.04	0.07	0.04	0.04	0.05	0.04	0.02	0.03	0.01	--
27	0.29	0.21	0.08	0.07	0.06	0.07	0.08	0.10	0.11	0.10	0.02	--
28	0.31	0.11	0.03	0.03	0.03	0.02	0.01	0.02	0.01	0.02	0.02	--
29	0.29	0.17	0.09	0.08	0.09	0.08	0.09	0.11	0.10	0.07	0.02	--
30	0.33	0.04	0.01	0.04	0.05	0.04	0.04	0.03	0.01	0.01	0.01	--
31	0.31	0.22	0.13	0.09	0.07	0.08	0.09	0.09	0.10	0.07	0.02	--
32	0.29	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.01	0.02	0.02	--
33	0.27	0.20	0.11	0.07	0.06	0.06	0.07	0.09	0.07	0.06	0.02	--
34	0.29	0.12	0.04	0.01	0.04	0.03	0.03	0.03	0.02	0.01	0.02	--
35	0.18	0.18	0.11	0.05	0.03	0.03	0.03	0.05	0.04	0.05	0.02	--
36	0.18	0.06	0.03	0.04	0.02	0.01	0.01	0.02	0.02	0.02	0.02	--
37	0.24	0.18	0.10	0.03	0.01	0.01	0.01	0.01	0.02	0.02	0.02	--
38	0.20	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.03	0.04	0.01	--
39	0.22	0.14	0.08	0.03	0.03	0.02	0.03	0.02	0.02	0.01	0.02	--
40	0.18	0.07	0.04	0.04	0.04	0.03	0.01	0.00	0.02	0.02	0.01	--

(5.2.4)	TABLE: Harmonic current limit test (EN 61000-3-2)						P
Model	NBQ800						
Harmonic	L1		--		--		Limits -A
	Magnitude (A)	% of I	Magnitude (A)	% of I	Magnitude (A)	% of I	
02	0.17	--	--	--	--	--	1.08
03	0.09	--	--	--	--	--	2.30
04	0.08	--	--	--	--	--	0.43
05	0.15	--	--	--	--	--	1.14
06	0.02	--	--	--	--	--	0.30
07	0.05	--	--	--	--	--	0.77
08	0.02	--	--	--	--	--	0.23
09	0.01	--	--	--	--	--	0.40
10	0.01	--	--	--	--	--	0.18
11	0.01	--	--	--	--	--	0.33
12	0.01	--	--	--	--	--	0.15
13	0.01	--	--	--	--	--	0.21
14	0.01	--	--	--	--	--	0.13
15	0.01	--	--	--	--	--	0.15
16	0.01	--	--	--	--	--	0.12
17	0.01	--	--	--	--	--	0.13
18	0.00	--	--	--	--	--	0.10
19	0.00	--	--	--	--	--	0.12
20	0.00	--	--	--	--	--	0.09
21	0.01	--	--	--	--	--	0.11
22	0.00	--	--	--	--	--	0.08
23	0.01	--	--	--	--	--	0.10
24	0.00	--	--	--	--	--	0.08
25	0.00	--	--	--	--	--	0.09
26	0.00	--	--	--	--	--	0.07
27	0.00	--	--	--	--	--	0.08
28	0.00	--	--	--	--	--	0.07
29	0.00	--	--	--	--	--	0.08
30	0.00	--	--	--	--	--	0.06
31	0.00	--	--	--	--	--	0.07
32	0.00	--	--	--	--	--	0.06
33	0.00	--	--	--	--	--	0.07
34	0.00	--	--	--	--	--	0.05
35	0.00	--	--	--	--	--	0.06
36	0.00	--	--	--	--	--	0.05
37	0.00	--	--	--	--	--	0.06
38	0.00	--	--	--	--	--	0.05
39	0.00	--	--	--	--	--	0.06
40	0.00	--	--	--	--	--	0.05
THD	--	3.25	--	--	--	--	--

(5.2.6)	TABLE: Direct current injection						P
Power P/Pn [%]	Measured DC output current						Limit [%]
	L1 [A]	L1 [%]	L2 [A]	L2 [%]	L3 [A]	L3 [%]	
95%	0.017	0.48	--	--	--	--	0.5%
66%	0.016	0.46	--	--	--	--	0.5%
33%	0.016	0.46	--	--	--	--	0.5%
Supplementary information: Main voltage 230V							

5.4.3	TABLE: Active power reduction through setting provision (P control)		P
Test Conditions	Measurements		Limit
P/Pn [%]	P/P_{Emax} [%]	$\Delta P/P_{Emax}$ [%]	Δ P/Pn [%]
100	98.88	1.12	≤ 5%
90	85.91	4.09	
80	76.54	3.46	
70	67.10	3.90	
60	58.16	1.84	
50	48.98	1.02	
40	39.52	0.48	
30	29.93	0.07	
20	20.13	0.13	
10	10.15	0.15	
No disconnection occurs			Y/N

5.4.3	TABLE: Active power reduction through setting provision (P control)	P
Test Conditions	Measurements	Limit
P/Pn [%]	ΔP/Δt [%Pn/s]	ΔP/Δt [%Pn/s]
100->5	0.54	0.33-0.66
5->100	0.56	

5.4.3	TABLE: Active power reduction through setting provision (P control)	P
Test Conditions	Measurements	Limit
P/Pn [%]	$T_{response}$ [s]	$T_{response}$ [s]
100->0	1.5	≤ 5
Note(s):		

5.5.2, 5.5.3, 5.5.4	TABLE: Interface switch (Functional safety)	N/A

☒ Integrated interface switch

☒ Complied with DIN EN 62109-2

Switch manufacturer and type:
Xiamen Hongfa Electroacoustics Co., Ltd; HF115F

Response time of interface switch for integrated NS protection: 20ms

The max. initial short-circuited current of PGU Ik": 1.52A

No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1.							

Supplement:
s-c: short-circuited, o-c: open-circuited, o-l: overload

6.5.2(5.5.7)	TABLE: Protection devices and protection settings (OV/UV)					P
Condition	Setting U/Un [%]	Measurement Trip value [V]				Limitation ΔU/Un [%]
		L123	L1	L2	L3	
U>>	125	--	291.43	--	--	≤±1.0
U<	80	--	186.68	--	--	
U<<	45	--	108.25	--	--	
Condition	Setting U/Un [%]	Measurement Trip value [V]				Limitation ΔU/Un [%]
		L123	L1-L2	L2-L3	L3-L1	
U>>	125	--	--	--	--	≤±1.0
U<	80	--	--	--	--	
U<<	45	--	--	--	--	
Condition	Setting [ms]	Measurement Trip time [ms]				Limitation [ms]
		L123	L1	L2	L3	
U>>	100	--	133	--	--	≤200
U<	3000	--	3020	--	--	3000-3100
U<<	300	--	373	--	--	300-400
Condition	Setting	Measurement Trip time [ms]				Limitation [ms]
		L123	L1-L2	L2-L3	L3-L1	
U>>	100	--	--	--	--	≤200
U<	3000	--	--	--	--	3000-3100
U<<	300	--	--	--	--	300-400
Condition	Setting [s]	Measurement Trip time [s]				Limitation [s]
		L123	L1	L2	L3	
U> 230->257.6	500	--	536	--	--	450-550
U> 230->248.4	No disconnect	--	No disconnect	--	--	No disconnect
U> 244->262.2	300	--	322	--	--	225-375
Note(s): Tests on L-L voltages are applicable to product over 30kVA.						

6.5.2(5.5.7)	TABLE: Protection devices and protection settings (OF/UF)		P
Condition	Setting f [Hz]	Measurement Trip value [Hz]	Limitation Δf/fn [%]
f>	51.5	51.5	≤±0.5
f<	47.5	47.6	
Condition	Setting [ms]	Measurement Trip time [ms]	Limitation [ms]
f>	100	193.5	≤200
f<	100	170.0	≤200
Note(s):			

6.5.3 (5.5.10)	TABLE: Islanding detection (per IEC 62116: 2014)					P
Power 100%						
Conditions	P_R [W]	Q_L [Var]	Q_C [Var]	Q_f	Trip time [ms]	Limitation [ms]
P_R: -10% Q_C: +10%	L1: 658	L1: 871	L1: 769	1.244	960	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -10% Q_C: +5%	L1: 653	L1: 831	L1: 769	0.224	820	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -10% Q_C: 0%	L1: 652	L1: 793	L1: 769	1.198	1894	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -10% Q_C: -5%	L1: 648	L1: 753	L1: 769	1.174	502	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -10% Q_C: -10%	L1: 646	L1: 714	L1: 769	1.1476	968	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -5% Q_C: +10%	L1: 692	L1: 871	L1: 769	1.183	500	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -5% Q_C: -10%	L1: 676	L1: 714	L1: 766	1.0940	833	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +10%	L1: 725	L1: 871	L1: 769	1.129	1083	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -5% Q_C: +5%	L1: 685	L1: 831	L1: 766	1.164	585	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -5% Q_C: 0%	L1: 683	L1: 793	L1: 766	1.139	1209	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: -5% Q_C: -5%	L1: 680	L1: 753	L1: 766	1.117	1737	
	L2: --	L2: --	L2: --	--		9000

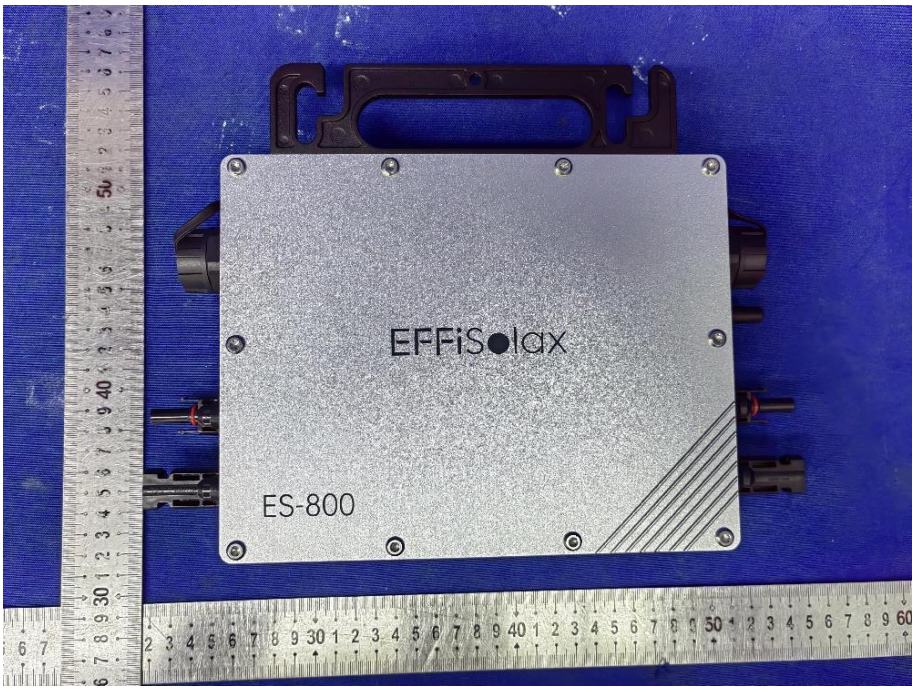
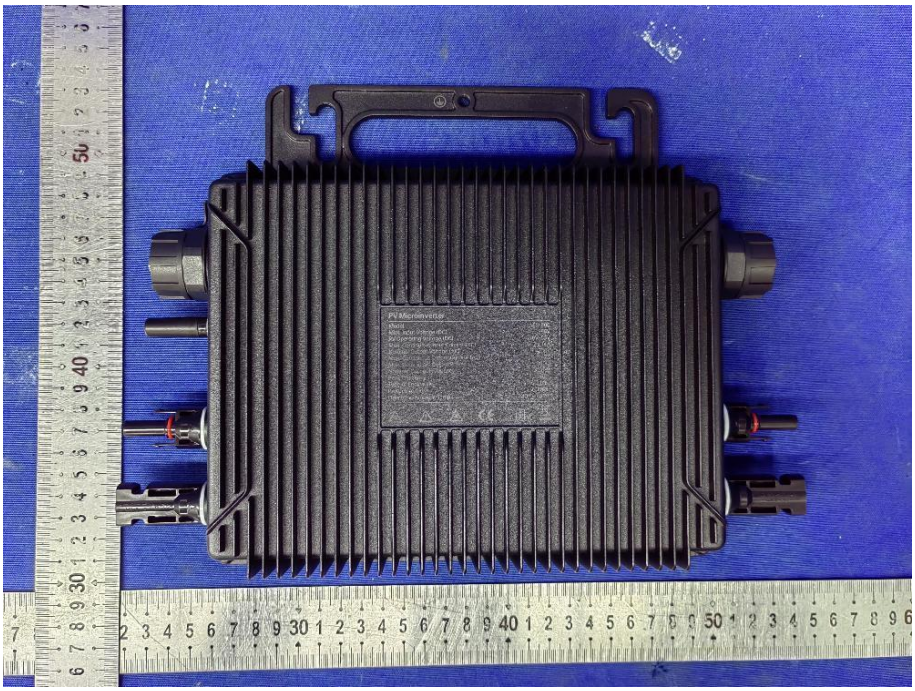
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +5%	L1: 720	L1: 831	L1: 769	1.111	1782	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: 0%	L1: 719	L1: 793	L1: 769	1.086	800	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -5%	L1: 714	L1: 753	L1: 769	1.0663	1703	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +5% Q_C: +5%	L1: 754	L1: 831	L1: 769	1.0598	619	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +5% Q_C: 0%	L1: 753	L1: 793	L1: 769	1.037	729	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +5% Q_C: -5%	L1: 749	L1: 753	L1: 769	1.016	737	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -10%	L1: 710	L1: 714	L1: 769	1.043	671	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +5% Q_C: +10%	L1: 758	L1: 871	L1: 769	1.078	774	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +5% Q_C: -10%	L1: 745	L1: 714	L1: 769	0.994	1097	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +10% Q_C: +10%	L1: 788	L1: 868	L1: 766	1.034	160	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +10% Q_C: +5%	L1: 782	L1: 828	L1: 765	1.017	417	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +10% Q_C: 0%	L1: 782	L1: 791	L1: 766	0.995	281	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +10% Q_C: -5%	L1: 781	L1: 753	L1: 769	0.9745	1126	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: +10% Q_C: -10%	L1: 779	L1: 714	L1: 769	0.951	331	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
Power 66%						
Conditions	P_R [W]	Q_L [Var]	Q_C [Var]	Q_f	Trip time [ms]	Limitation [ms]
P_R: 0%	L1: 471	L1: 476	L1: 461	0.995	635	

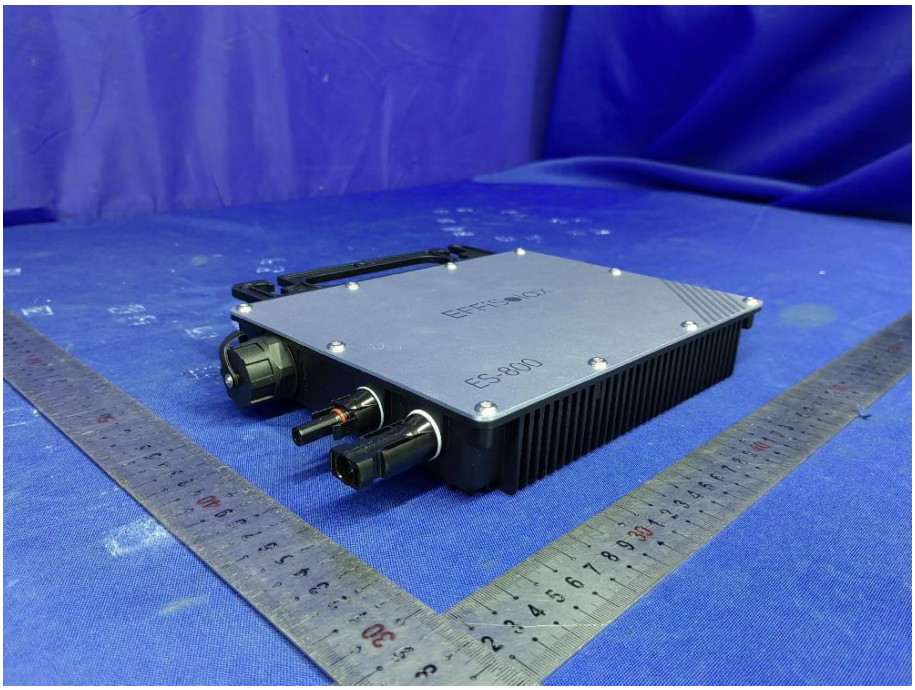
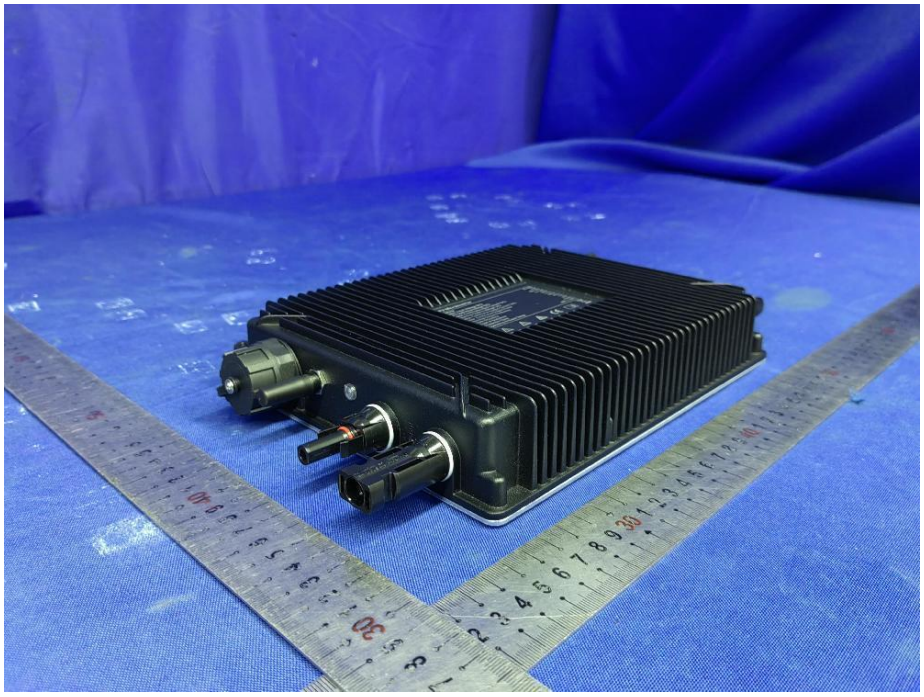
Q_C: -5%	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -4%	L1: 472	L1: 482	L1: 461	0.998		
	L2: --	L2: --	L2: --	--	360	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -3%	L1: 473	L1: 486	L1: 461	1.001		
	L2: --	L2: --	L2: --	--	990	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -2%	L1: 473	L1: 492	L1: 461	1.007		
	L2: --	L2: --	L2: --	--	523	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -1%	L1: 474	L1: 497	L1: 461	1.009		
	L2: --	L2: --	L2: --	--	292	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: 0%	L1: 475	L1: 502	L1: 461	1.013		
	L2: --	L2: --	L2: --	--	887	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +1%	L1: 475	L1: 507	L1: 461	1.017		
	L2: --	L2: --	L2: --	--	778	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +2%	L1: 476	L1: 512	L1: 461	1.020		
	L2: --	L2: --	L2: --	--	283	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +3%	L1: 474	L1: 515	L1: 461	1.029		
	L2: --	L2: --	L2: --	--	572	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +4%	L1: 474	L1: 520	L1: 461	1.032		
	L2: --	L2: --	L2: --	--	433	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: +5%	L1: 475	L1: 525	L1: 461	1.037		
	L2: --	L2: --	L2: --	--	822	9000
	L3: --	L3: --	L3: --	--		
Power 33%						
Conditions	P_R [W]	Q_L [Var]	Q_C [Var]	Q_f	Trip time [ms]	Limitation [ms]
P_R: 0% Q_C: -5%	L1: 238	L1: 278	L1: 213	1.022		
	L2: --	L2: --	L2: --	--	632	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -4%	L1: 239	L1: 282	L1: 213	1.027		
	L2: --	L2: --	L2: --	--	761	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -3%	L1: 239	L1: 284	L1: 213	1.031		
	L2: --	L2: --	L2: --	--	511	9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_C: -2%	L1: 239	L1: 288	L1: 213	1.036		
	L2: --	L2: --	L2: --	--	588	9000
	L3: --	L3: --	L3: --	--		

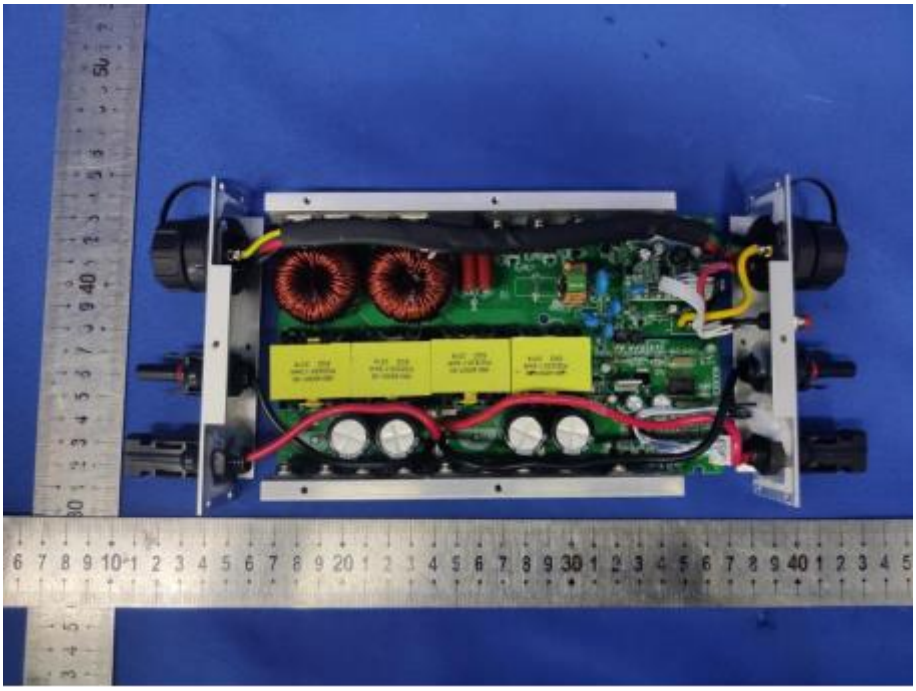
P_R: 0% Q_c: -1%	L1: 239	L1: 291	L1: 213	1.044	651	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_c: 0%	L1: 239	L1: 294	L1: 213	1.046	976	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_c: +1%	L1: 240	L1: 297	L1: 213	1.048	583	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_c: +2%	L1: 241	L1: 300	L1: 213	1.049	720	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_c: +3%	L1: 234	L1: 303	L1: 213	1.085	401	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_c: +4%	L1: 234	L1: 306	L1: 213	1.087	674	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		
P_R: 0% Q_c: +5%	L1: 235	L1: 309	L1: 213	1.091	700	
	L2: --	L2: --	L2: --	--		9000
	L3: --	L3: --	L3: --	--		

8.3(5.6)	TABLE: Connection conditions and synchronization (Reconnection)			P
Condition	Measurement		Limitation	
	Reconnection	Delay time [s]	Reconnection	Delay time [s]
f<47.45Hz	No	--	No	≥60
f≥47.55Hz	Yes	216.3	Yes	≥60
f>50.15Hz	No	--	No	≥60
f≤50.05Hz	Yes	80.1	Yes	≥60
U<0.84Un	No	--	No	≥60
U≥0.86Un	Yes	72.8	Yes	≥60
U>1.11Un	No	--	No	≥60
U≤1.09Un	Yes	60.4	Yes	≥60
Note(s):				

Appendix table 2 -Photos of the product

Overview

Overview -


Overview

Overview -


Inside view

Inside view