Certificate of compliance

Applicant:	**UPOWER ELECTRIC CO., LTD** 4F-A Block, No.62, Yinhe Road, Longgang District, Shenzhen, Guangdong **China**
Product:	**Photovoltaic (PV) and battery inverter**
Model:	**UHome-3K0L** **UHome-3K6L**

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G98/1 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G98/1-7:2022
Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks

DIN V VDE V 0126-1-1:2006 (4.1 Functional safety)
Automatic disconnection device between a generator and the public low-voltage grid

At the time of issue of this certificate, the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.

Report number:	**CIZC-ESH-P22120608**	**Certification program:**	**NSOP-0032-DEU-ZE-V01**
Certificate number:	**U23-1080**	**Date of issue:**	**2023-11-29**

Certification body

Domenik Koll
Head of Energy Systems

DAkkS Deutsche Akkreditierungsstelle D-ZE-12024-01-00

Certification body Bureau Veritas Consumer Products Services Germany GmbH accredited according to DIN EN ISO/IEC 17065

Testing laboratory accredited according to DIN EN ISO/IEC 17025

A partial representation of the certificate requires the written approval of Bureau Veritas Consumer Products Services Germany GmbH

Annex to the G98/1 certificate of compliance No. U23-1080

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G98/1.				
PGM Technology	Photovoltaic and battery inverter			
Manufacturer	**UPOWER ELECTRIC CO., LTD**			
Address	4F-A Block, No.62, Yinhe Road, Longgang District, Shenzhen, Guangdong China			
Tel	--	**Fax**	--	
Email	--	**Website**	--	
Rated values	**UHome-3K0L**	**UHome-3K6L**	--	--
PV Input (DC)				
MPP DC voltage range [V]	80-500		--	--
Max. input DC voltage [V]	550		--	--
Max. input DC current [A]	14/14	14/14	--	--
Battery (DC)				
Battery DC voltage range [V]	44,8-57,6		--	--
Battery nominal voltage [V]	51,2		--	--
Battery charge / discharge current [A]	60	72	--	--
Grid Output (AC)				
Output AC voltage [V]	L/N/PE, 230, 50/60 Hz		--	--
Rated AC current [A]	13,0	16,0	--	--
Max AC current [A]	14,3	16,0	--	--
Active Power [W]	3000	3680	--	--
Max. apparent power [VA]	3300	3680	--	--
Back-up Mode				
Max. output current [A]	13,0	16,0	--	--
Max. output power [VA]	3300	3680	--	--
Firmware version	DSP: V1.05.07 ARM: V1.04.15			
Description of the structure of the power generation unit: The power generation unit is equipped with a PV and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in (each) line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.				
Differences between Generating Units: The models UHome-3K0L, UHome-3K6L are identical in hardware and software, and the output power derated by software.				
The above stated Generating Units are tested according the requirements in the Engineering Recommendation G98/1. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G98/1.				

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Operating Range.	
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47,0 Hz Power Factor = 1 Period of test 20 seconds
Connection:	Always connected
Limit:	No disconnection allowed
Test 2	Voltage = 85% of nominal (195,5 V) Frequency = 47,5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	No disconnection allowed
Test 3	Voltage = 110% of nominal (253 V) Frequency = 51,5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	No disconnection allowed
Test 4	Voltage = 110% of nominal (253 V) Frequency = 52,0 Hz Power Factor = 1 Period of test 15 minutes
Connection:	Always connected
Limit:	No disconnection allowed
Test 5	Voltage = 100% of nominal (230 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	No disconnection allowed
Test 6	Confirm that the Micro-Generating Plant is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs-1 as measured over a period of 500 ms.
Connection:	Always connected
Limit:	No disconnection allowed

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Protection. Voltage tests.

Phase 1

Function	Setting		Trip test		No trip test	
	Voltage [V]	Time delay [s]	Voltage [V]	Time delay [s]	Voltage / time	Confirm no trip
U/V	184,0	2,5	184,03	2,51	188V / 5s	No trip
					180V / 2,45s	No trip
O/V stage 1	262,2	1,0	262,21	1,00	258,2V 5,0s	No trip
O/V stage 2	273,7	0,5	273,44	0,50	269,7V 0,95s	No trip
					277,7V 0,45s	No trip

Note. For Voltage tests the Voltage required to trip is the setting ±3,45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection. Frequency tests.

Function	Setting		Trip test		No trip test	
	Frequency [Hz]	Time delay [s]	Frequency [Hz]	Time delay [s]	Frequency / time	Confirm no trip
U/F stage 1	47,5	20	47,50	20,00	47,7Hz / 30s	No trip
U/F stage 2	47	0,5	47,00	0,500	47,2Hz / 19,5s	No trip
					46,8Hz / 0,45s	No trip
O/F stage 2	52	0,5	52,00	0,500	51,8Hz / 120s	No trip
					52,2Hz / 0,45s	No trip

Note. For Frequency Trip tests the Frequency required to trip is the setting ± 0,1Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The “No-trip tests” need to be carried out at the setting ± 0,2Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Protection. Loss of Mains.						
Inverters tested according to BS EN 62116.						
Balancing load on islanded network	33% of -5% Q Test 22	66% of -5% Q Test 12	100% of -5% P Test 5	33% of +5% Q Test 31	66% of +5% Q Test 21	100% of +5% P Test 10
Trip time. Ph1 fuse removed [ms]	294,00	156,00	263,20	213,60	243,00	258,20
Note. Trip time limit is 0,5s.						

Protection. Re-connection timer.	
Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 2.	
Over Voltage	
Time delay setting [s]	**Measured delay [s]**
20	23,4
Under Voltage	
Time delay setting [s]	**Measured delay [s]**
20	26,0
Over Frequency	
Time delay setting [s]	**Measured delay [s]**
20	27,4
Under Frequency	
Time delay setting [s]	**Measured delay [s]**
20	28,2

	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	At 266,2V	At 180,0V	At 47,4Hz	At 52,1Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Protection. Frequency change, Stability test.				
	Start Frequency [Hz]	**Change**	**Test Duration**	**Confirm no trip**
Positive Vector Shift	49,5	+50 degrees		No trip
Negative Vector Shift	50,5	-50 degrees		No trip
Positive Frequency drift	49,0 to 51,0	+0,95Hz/sec	2,1s	No trip
Negative Frequency drift	51,0 to 49,0	-0,95Hz/sec	2,1s	No trip

Limited Frequency Sensitive Mode – Over Frequency							
1-min mean value [Hz]:	**a) 50,00**	**b) 50,45**	**c) 50,70**	**d) 51,15**	**e) 50,70**	**f) 50,45**	**g) 50,00**
1. Measurement a) to g): Active power output > 80% P_n							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [W]:	3680	3643	3459	3128	3459	3643	3680
$P_{measured}$ [W]:	3615	3518	3368	3099	3366	3521	3617
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [W]:	1840	1803	1619	1288	1619	1803	3680
$P_{measured}$ [W]:	1833	1802	1649	1380	1636	1785	3633

Output Power with falling Frequency			
5-min mean value (each)	**a) 50 ± 0,01 Hz**	**b) - 0,4 to - 0,5 Hz**	**c) - 2,4 to - 2,5 Hz**
Frequency [Hz]:	50,00	49,50	47,50
Active power [W]:	3663	3658	3650
ΔP/Pmax [%]:			-0,82

Note.
No Power reduction takes place for electronic inverter.

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98/1	Nr. CIZC-ESH-P22120608

Power Quality. Harmonics.

UHome-3K6L

Phase 1

SSEG rating per phase (rpp)						
	At 45-55% of rated outputs 1820W		100% of rated output 3628W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2nd	0,069	0,440	0,113	0,721	1,080	
3rd	0,288	1,843	0,442	2,822	2,300	
4th	0,030	0,190	0,018	0,115	0,430	
5th	0,145	0,924	0,021	0,134	1,140	
6th	0,020	0,127	0,023	0,147	0,300	
7th	0,088	0,562	0,126	0,806	0,770	
8th	0,020	0,128	0,009	0,056	0,230	
9th	0,063	0,405	0,074	0,475	0,400	
10th	0,014	0,089	0,017	0,109	0,184	
11th	0,048	0,307	0,059	0,378	0,330	
12th	0,015	0,094	0,020	0,129	0,153	
13th	0,096	0,616	0,180	1,147	0,210	
14th	0,008	0,052	0,008	0,053	0,131	
15th	0,052	0,335	0,105	0,668	0,150	
16th	0,005	0,035	0,010	0,065	0,115	
17th	0,031	0,200	0,075	0,479	0,132	
18th	0,016	0,101	0,008	0,053	0,102	
19th	0,019	0,119	0,056	0,356	0,118	
20th	0,014	0,090	0,006	0,041	0,092	
21th	0,013	0,083	0,042	0,267	0,107	0,160
22th	0,008	0,051	0,006	0,037	0,084	
23th	0,006	0,041	0,031	0,201	0,098	0,147
24th	0,005	0,029	0,004	0,028	0,077	
25th	0,004	0,024	0,023	0,150	0,090	0,135
26th	0,005	0,029	0,003	0,017	0,071	
27th	0,002	0,015	0,020	0,129	0,083	0,124
28th	0,003	0,017	0,003	0,020	0,066	
29th	0,001	0,005	0,015	0,096	0,078	0,117
30th	0,002	0,015	0,004	0,024	0,061	
31th	0,002	0,013	0,012	0,077	0,073	0,109
32th	0,002	0,012	0,003	0,021	0,058	
33th	0,003	0,019	0,010	0,067	0,068	0,102
34th	0,001	0,009	0,004	0,025	0,054	
35th	0,003	0,019	0,009	0,060	0,064	0,096
36th	0,003	0,017	0,003	0,020	0,051	
37th	0,003	0,019	0,009	0,057	0,061	0,091
38th	0,003	0,017	0,003	0,021	0,048	
39th	0,003	0,016	0,007	0,042	0,058	0,087
40th	0,003	0,021	0,006	0,039	0,046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98/1	Nr. CIZC-ESH-P22120608

Power Quality. Harmonics.

UHome-3K0L

Phase 1

SSEG rating per phase (rpp)						
	At 45-55% of rated outputs 1520W		100% of rated output 3028W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2nd	0,055	0,424	0,082	0,627	1,080	
3rd	0,198	1,517	0,381	2,921	2,300	
4th	0,020	0,153	0,013	0,097	0,430	
5th	0,096	0,735	0,047	0,357	1,140	
6th	0,016	0,122	0,013	0,097	0,300	
7th	0,064	0,494	0,103	0,791	0,770	
8th	0,016	0,124	0,007	0,050	0,230	
9th	0,048	0,366	0,034	0,261	0,400	
10th	0,010	0,076	0,011	0,083	0,184	
11th	0,037	0,281	0,048	0,369	0,330	
12th	0,022	0,171	0,012	0,090	0,153	
13th	0,085	0,655	0,144	1,106	0,210	
14th	0,006	0,049	0,008	0,064	0,131	
15th	0,051	0,389	0,080	0,614	0,150	
16th	0,005	0,038	0,007	0,050	0,115	
17th	0,035	0,269	0,062	0,472	0,132	
18th	0,005	0,039	0,005	0,042	0,102	
19th	0,023	0,173	0,045	0,343	0,118	
20th	0,004	0,033	0,005	0,039	0,092	
21th	0,015	0,114	0,036	0,279	0,107	0,160
22th	0,004	0,027	0,004	0,030	0,084	
23th	0,011	0,084	0,029	0,223	0,098	0,147
24th	0,003	0,023	0,004	0,034	0,077	
25th	0,007	0,057	0,024	0,183	0,090	0,135
26th	0,003	0,021	0,004	0,033	0,071	
27th	0,005	0,041	0,020	0,156	0,083	0,124
28th	0,003	0,023	0,004	0,027	0,066	
29th	0,004	0,028	0,016	0,120	0,078	0,117
30th	0,002	0,013	0,003	0,024	0,061	
31th	0,002	0,019	0,014	0,105	0,073	0,109
32th	0,002	0,014	0,003	0,023	0,058	
33th	0,002	0,014	0,012	0,090	0,068	0,102
34th	0,002	0,018	0,003	0,024	0,054	
35th	0,002	0,013	0,009	0,070	0,064	0,096
36th	0,002	0,015	0,002	0,016	0,051	
37th	0,001	0,007	0,008	0,062	0,061	0,091
38th	0,003	0,023	0,003	0,024	0,048	
39th	0,002	0,014	0,006	0,043	0,058	0,087
40th	0,001	0,010	0,002	0,019	0,046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Power Quality. Power factor.				
Output power	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1,5% of the stated level during the test.
20%	0,9864	0,9804	0,9733	
50%	0,9986	0,9979	0,9968	
75%	0,9996	0,9993	0,9989	
100%	0,9998	0,9997	0,9995	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			**Stopping**			**Running**	
	d_{max} [%]	**dc [%]**	**$d_{(t)}$ [%]**	**d_{max} [%]**	**dc [%]**	**$d_{(t)}$ [%]**	**Pst**	**Plt 2 hours**
Measured values at test impedance	0,25	0,14	0,00	0,17	0,08	0,00	0,23	0,14
Measured values at standard impedance	0,25	0,14	0,00	0,17	0,08	0,00	0,23	0,14
Values for maximum impedance	0,25	0,14	0,00	0,17	0,08	0,00	0,23	0,14
Limits set under BS EN 61000-3-11	4,0	3,3	3,3 500ms	4,0	3,3	3,3 500ms	1,0	0,65

Test impedance	R	0,4	Ω	Xl	0,25	Ω
	Z	0,47	Ω			
Standard impedance	R	0,4	Ω	Xl	0,25	Ω
	Z	0,40	Ω			
Maximum impedance	R	0,4	Ω	Xl	0,25	Ω
	Zmax	0,47	Ω			

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Power Quality. DC injection.

UHome-3K0L

Test level power [%]	20	50	75	100
Recorded value [mA]	23	18	28	28
Recorded value [%]	0,18	0,14	0,22	0,22
Limit [%]	0,25	0,25	0,25	0,25

Sum of all Phases

Tests are carried out at three defined power levels ± 5%. At 230 V a 3 kW three phase Inverter has a current output of 13,04 A so DC limit is 32 mA. These tests is undertaken in accordance with Annex A.1.3.4

The % DC injection (“as % of rated AC current” below) is calculated as follows:

% DC injection = Recorded DC value in Amps / Base current where the base current is the Registered Capacity (W) / V phase. The % DC injection should not be greater than 0,25%.

UHome-3K6L

Test level power [%]	20	50	75	100
Recorded value [mA]	31	33	36	35
Recorded value [%]	0,19	0,21	0,23	0,22
Limit [%]	0,25	0,25	0,25	0,25

Sum of all Phases

Tests are carried out at three defined power levels ± 5%. At 230 V a 3,68 kW three phase Inverter has a current output of 16,00 A so DC limit is 40 mA. These tests is undertaken in accordance with Annex A.1.3.4

The % DC injection (“as % of rated AC current” below) is calculated as follows:

% DC injection = Recorded DC value in Amps / Base current where the base current is the Registered Capacity (W) / V phase. The % DC injection should not be greater than 0,25%.

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98/1	**Nr. CIZC-ESH-P22120608**

Fault level Contribution.					
For a directly coupled SSEG			**For a Inverter SSEG**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts [V]**	**Amps [A]**
Peak Short Circuit current	I_p	N/A	20 ms	12,7	0,0
Initial Value of aperiodic current	A	N/A	100 ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250 ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500 ms	N/A	N/A
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,019	
For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.					

Self Monitoring – Solid state switching.	**N/A**
It has been verified that in the event of the solid state switching device failing to disconnect the Generating Unit, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.	
Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1)	

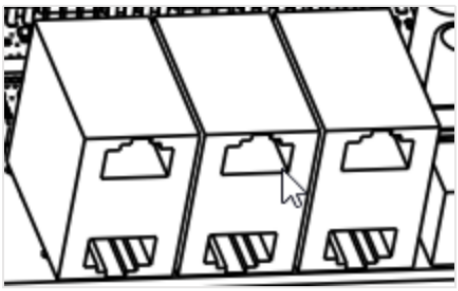
Cyber security	**P**
Confirm that the Manufacturer or Installer of the Micro-generator has provided a statement describing how the Micro-generator has been designed to comply with cyber security requirements, as detailed in 9.7.	Yes
Note. Different levels of access, all are password protected, only certain parameters can be changed on maintenance level. Manufacturer information provided.	

Achtung! Genau prüfen ob dies im Bericht ist!

Logic Interface (input port) Required by paragraph 9.4.4	**P**
Confirm that an input port is provided and can be used to reduce the Active Power output to zero	Yes
Note. Manufacturer information provided.	
Provide high level description of logic interface, e.g. details in 9.4.4 such as AC or DC signal	Yes
By default, the DRM logical interface will take the form of a simple binary output that can be operated by a simple switch controlled by pins 2 and 5 of the RJ45. Pin 2 outputs 3.3V DC signal, pin 5 is ground signal. After turning off the switch, the inverter works normally. After the switch is turned on, the energy yield of the inverter falls to 0 within 5 seconds	

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98/1	Nr. CIZC-ESH-P22120608



DRM	CT	CAN1
LEAD NTC	CAN_BMS 485_BMS	CAN2

* Port Function

- CAN1/CAN2: Communication interface for connecting inverter.
- CAN_BMS/ 485_BMS: BMS communication for lithium batteries.
- CT: For external grid side CT to detect current size.
- DRM: Reserve dry contact for engine start signal.
- NTC: Used for communication of battery temperature.