Certificate of compliance

Applicant:	**WeCo SRL** Viale Kennedy 113-121 Scarperia e San Piero,Firenze **Italy**
Product:	**Hybrid Inverter**
Model:	ESY-4K ESY-4.6K ESY-5K ESY-6K ESY-8K

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G99/1 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 G99/1-9:2022
Requirements for the connection of generation equipment in parallel with public distribution networks

Annex A – Type A Power Generating Modules

DIN VDE V 0124-100:2020 (5.5.2.1 Functional safety of network and system protection)
Grid integration of generator plants - Low-voltage - Test requirements for generator units to be connected to and operated in parallel with low-voltage distribution networks

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:	**CLUY-ESH-P23101056**	**Certification program:**	**NSOP-0032-DEU-ZE-V01**
Certificate number:	**U24-0213**	**Date of issue:**	**2024-03-28**

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 G99/1 certificate of compliance No. U24-0213

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. CLUY-ESH-P23101056**

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G99.			
PGM Technology:	Hybrid Inverter		
Manufacturer:	**WeCo (Guangdong) Energy Storage Technology Co., Ltd.**		
Address:	Building 1, No.2 of Zhengda Road, Chukeng, Dongkeng District, Dongguan city, Guangdong province		
Tel	--	**Fax:**	--
Email:	--	**Website:**	--

Rated values	**ESY-4K**	**ESY-4.6K**	**ESY-5K**	**ESY-6K**
MPP voltage range [V]	80-500	80-500	80-500	80-500
Max. input voltage [V]	550	550	550	550
Max. input current per MPP tracker [A]	16/16	16/16	16/16	16/16
Output AC voltage [V]	L/N/PE, 230, 50 Hz			
Output AC current [A]	17,4	20	21,7	26
Max. output current [VA]	19,1	20	21,7	28,7
Rated output power [W]	4000	4600	5000	6000
Rated apparent power [VA]	4000	4600	5000	6000
Battery DC voltage range [V]	40-58	40-58	40-58	40-58
Battery charge current [A]	80	92	100	120
Battery discharge current [A]	80	92	100	120

Rated values	**ESY-8K**	--	--	--
MPP voltage range [V]	80-500	--	--	--
Max. input voltage [V]	550	--	--	--
Max. input current per MPP tracker [A]	16/16	--	--	--
Output AC voltage [V]	L/N/PE, 230, 50 Hz	--	--	--
Output AC current [A]	35	--	--	--
Max. output current [VA]	38,3	--	--	--
Rated output power [W]	8000	--	--	--
Rated apparent power [VA]	8000	--	--	--
Battery DC voltage range [V]	40-58	--	--	--
Battery charge current [A]	160	--	--	--
Battery discharge current [A]	160	--	--	--

Firmware version	V1.02

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.

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

Differences between Generating Units:

Component\Model	ESY-4K, ESY-4.6K, ESY-5K, ESY-6K	ESY-8K
IGBT Infine IKW50N65EH5	10pcs IGBT3-IGBT8 Q9-Q12	7pcs Q9-Q12 IGBT1, IGBT9 IGBT2
IGBT Infine IKW50N65SS5	not used	2pcs IGBT7, IGBT8
IGBT Infine IKW50N65ES5	not used	4pcs IGBT5, IGBT3, IGBT4, IGBT6
IGBT Infine IKW50N65H5	2pcs IGBT1, IGBT9	not used
Input electrolytic capacitors ;AiShi ;63V;1200uF;±20%	15pcs C1-C15	not used
Input electrolytic capacitors ;AiShi ;63V;1800uF;±20%	not used	15pcs C1-C15
BUS capacitance ; AiShi; 550V;470uF;±20%	7pcs C32-C38	not used
BUS capacitance; AiShi; 550V;680uF;±20%	not used	7pcs C32-C38
Output relay: HongFa; HF161F-40W 50A	6pcs K1-K4, K9, K10	not used
Output relay: ONG CHUAN :117L 66A	not used	6pcs K1-K4, K9, K10
inductance	PV1, PV2: 1.11mH±10%@0A"0.7mH±10%@15A0.7 mH±10% INV1, INV2: 1690uH±10%@0A0.77mH±10% BAT: 0.8mH±10%@0A0.21mH±10%	PV1, PV2: 0.836mH±10%@0A0.6mH±10% INV1, INV2: 0.48mH±10%@0A0.42mH±10% BAT: 0.8mH±10%@0A0.21mH±10%
Enclosure size	454.5 by 467 by 200 mm	484.5 by 467 by 200 mm

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G99/1. 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 G99/1.

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

Operating Range.	
Test 1	Voltage = 85% of nominal (195,5V) Frequency = 47Hz Power Factor = 1 Period of test 20 s
Connection:	Always connected
Limit:	Always connected
Test 2	Voltage = 85% of nominal (195,5V) Frequency = 47,5Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 3	Voltage = 110% of nominal (253V) Frequency = 51,5Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 4	Voltage = 110% of nominal (253V) Frequency = 52,0Hz Power Factor = 1 Period of test 15 minutes
Connection:	Always connected
Limit:	Always connected
Test 5	Voltage = 100% of nominal (230 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 6	Confirm that the Power Generating Module 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 500ms. Note that this is not expected to be demonstrated on site.
Connection:	Always connected
Limit:	Always connected

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. CLUY-ESH-P23101056**

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	2,5	184,0V	2,52s	188V / 5,0s	No trip
					180V / 2,45s	No trip
O/V stage 1	262,2	1,0	262,0	1,01	258,2V 5,0s	No trip
O/V stage 2	273,7	0,5	272,6	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	47,48	20,04	47,7Hz / 30s	No trip
U/F stage 2	47	0,5	46,97	0,50	47,2Hz / 19,5s	No trip
					46,8Hz / 0,45s	No trip
O/F stage 2	52	0,5	52,06	0,51	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.

Compliance Verification Report for Inverter Connected Power Generating Modules	
Extract from test report according to the Engineering Recommendation G99	**Nr. CLUY-ESH-P23101056**

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 [s]	315,0	288,0	340,0	334,	318,0	356,0
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 10.1.	
Over Voltage (258,2 V)	
Time delay setting	**Measured delay**
20s	25,26 s
Under Voltage (188,0 V)	
Time delay setting	**Measured delay**
20s	32,26 s
Over Frequency (51,9 Hz)	
Time delay setting	**Measured delay**
20s	25,26 s
Under Frequency (47,6 Hz)	
Time delay setting	**Measured delay**
20s	27,31 s

	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

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

Compliance Verification Report for Inverter Connected Power Generating Modules	
Extract from test report according to the Engineering Recommendation G99	**Nr. CLUY-ESH-P23101056**

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% Pn							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [kW]:	N/A	7920	7520	6800	7520	7920	N/A
$P_{measured}$ [kW]:	7991	7916	7517	6802	7517	7915	7992
2. Measurement a) to g): Active power output 40% and 60% Pn							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
$P_{expected}$ [kW]:	N/A	3920	3520	2800	3520	3920	N/A
$P_{measured}$ [kW]:	3999	3921	3518	2796	3520	3922	7991

Output Power with falling Frequency						
Frequency setpoint [Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Frequency [Hz]:	50,00	49,50	49,00	48,00	47,60	47,10
Active power [kW]:	7992	7987	7987	7973	7967	7957
ΔP/Pmax [%]:		-0,16	-0,16	-0,34	-0,41	-0,54

Note.
No Power reduction takes place for electronic inverter

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. CLUY-ESH-P23101056**

Power Quality. Harmonics.

ESY-8K

Generating Unit rating per phase (rpp)			8000W			
	At 45-55% of rated output 4023 W		100% of rated output 7999 W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,112	0,321	0,031	0,088	8%	8%
3rd	0,494	1,421	1,262	3,628	21,6%	N/A
4th	0,035	0,100	0,074	0,213	4%	4%
5th	0,094	0,270	0,341	0,981	10,7%	10,7%
6th	0,012	0,034	0,036	0,104	2,67%	2,67%
7th	0,124	0,356	0,160	0,459	7,2%	7,2%
8th	0,013	0,037	0,090	0,260	2%	2%
9th	0,021	0,059	0,047	0,136	3,8%	N/A
10th	0,008	0,022	0,029	0,083	1,6%	1,6%
11th	0,066	0,190	0,071	0,205	3,1%	3,1%
12th	0,015	0,042	0,078	0,224	1,33%	1,33%
13th	0,150	0,430	0,226	0,650	2%	2%
14th	0,010	0,030	0,042	0,121	N/A	N/A
15th	0,083	0,239	0,130	0,372	N/A	N/A
16th	0,007	0,021	0,018	0,052	N/A	N/A
17th	0,061	0,174	0,061	0,176	N/A	N/A
18th	0,007	0,021	0,006	0,018	N/A	N/A
19th	0,043	0,123	0,064	0,184	N/A	N/A
20th	0,006	0,018	0,010	0,027	N/A	N/A
21th	0,034	0,098	0,044	0,126	N/A	N/A
22th	0,005	0,015	0,004	0,012	N/A	N/A
23th	0,025	0,071	0,047	0,134	N/A	N/A
24th	0,005	0,014	0,008	0,022	N/A	N/A
25th	0,021	0,061	0,033	0,094	N/A	N/A
26th	0,004	0,012	0,005	0,015	N/A	N/A
27th	0,016	0,045	0,032	0,092	N/A	N/A
28th	0,003	0,010	0,012	0,035	N/A	N/A
29th	0,014	0,039	0,027	0,077	N/A	N/A
30th	0,003	0,010	0,004	0,010	N/A	N/A
31th	0,011	0,031	0,023	0,065	N/A	N/A
32th	0,003	0,009	0,006	0,018	N/A	N/A
33th	0,010	0,028	0,021	0,059	N/A	N/A
34th	0,003	0,008	0,003	0,010	N/A	N/A
35th	0,007	0,021	0,020	0,059	N/A	N/A
36th	0,003	0,008	0,005	0,013	N/A	N/A
37th	0,007	0,020	0,016	0,047	N/A	N/A
38th	0,002	0,007	0,004	0,012	N/A	N/A
39th	0,006	0,017	0,015	0,043	N/A	N/A
40th	0,003	0,010	0,005	0,015	N/A	N/A
THD_{40} [%]	--	3,270	--	2,178	23%	13%
PWHD [%]	--	1,543	--	2,404	23%	22%

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 | **Nr. CLUY-ESH-P23101056**

Power Quality. Harmonics.

ESY-6K

Generating Unit rating per phase (rpp)			6000 W			
	At 45-55% of rated output 3040 W		100% of rated output 6026 W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,082	0,315	0,109	0,417	8%	8%
3rd	0,315	1,209	0,864	3,313	21,6%	N/A
4th	0,008	0,030	0,141	0,540	4%	4%
5th	0,018	0,068	0,225	0,863	10,7%	10,7%
6th	0,018	0,069	0,014	0,054	2,67%	2,67%
7th	0,097	0,373	0,126	0,483	7,2%	7,2%
8th	0,012	0,047	0,027	0,102	2%	2%
9th	0,062	0,238	0,026	0,099	3,8%	N/A
10th	0,013	0,048	0,015	0,059	1,6%	1,6%
11th	0,041	0,158	0,077	0,297	3,1%	3,1%
12th	0,017	0,064	0,032	0,122	1,33%	1,33%
13th	0,123	0,472	0,185	0,710	2%	2%
14th	0,010	0,038	0,013	0,048	N/A	N/A
15th	0,068	0,262	0,105	0,403	N/A	N/A
16th	0,008	0,032	0,010	0,040	N/A	N/A
17th	0,047	0,182	0,061	0,235	N/A	N/A
18th	0,006	0,023	0,006	0,022	N/A	N/A
19th	0,033	0,126	0,060	0,229	N/A	N/A
20th	0,005	0,020	0,012	0,045	N/A	N/A
21th	0,024	0,091	0,040	0,153	N/A	N/A
22th	0,004	0,017	0,004	0,016	N/A	N/A
23th	0,017	0,066	0,038	0,146	N/A	N/A
24th	0,003	0,013	0,008	0,029	N/A	N/A
25th	0,012	0,047	0,031	0,119	N/A	N/A
26th	0,004	0,014	0,004	0,017	N/A	N/A
27th	0,010	0,037	0,026	0,099	N/A	N/A
28th	0,003	0,011	0,004	0,016	N/A	N/A
29th	0,007	0,027	0,022	0,086	N/A	N/A
30th	0,003	0,011	0,005	0,018	N/A	N/A
31th	0,006	0,022	0,020	0,075	N/A	N/A
32th	0,002	0,009	0,003	0,011	N/A	N/A
33th	0,005	0,019	0,016	0,060	N/A	N/A
34th	0,002	0,009	0,004	0,016	N/A	N/A
35th	0,004	0,015	0,016	0,062	N/A	N/A
36th	0,002	0,009	0,003	0,012	N/A	N/A
37th	0,004	0,014	0,012	0,046	N/A	N/A
38th	0,002	0,008	0,003	0,012	N/A	N/A
39th	0,004	0,015	0,012	0,046	N/A	N/A
40th	0,003	0,011	0,004	0,015	N/A	N/A
THD_{40} [%]	--	2,948	--	3,675	23%	13%
PWHD [%]	--	1,575	--	2,687	23%	22%

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. CLUY-ESH-P23101056**

Power Quality. Harmonics.

ESY-5K

Generating Unit rating per phase (rpp)			5000 W			
	At 45-55% of rated output 2553 W		100% of rated output 5043 W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,039	0,179	0,004	0,019	8%	8%
3rd	0,261	1,201	0,150	0,690	21,6%	N/A
4th	0,017	0,076	0,004	0,017	4%	4%
5th	0,037	0,170	0,048	0,222	10,7%	10,7%
6th	0,005	0,025	0,003	0,012	2,67%	2,67%
7th	0,093	0,426	0,063	0,291	7,2%	7,2%
8th	0,007	0,031	0,002	0,011	2%	2%
9th	0,070	0,320	0,098	0,449	3,8%	N/A
10th	0,006	0,026	0,003	0,012	1,6%	1,6%
11th	0,029	0,132	0,064	0,296	3,1%	3,1%
12th	0,007	0,034	0,002	0,011	1,33%	1,33%
13th	0,105	0,483	0,044	0,204	2%	2%
14th	0,005	0,025	0,002	0,011	N/A	N/A
15th	0,059	0,271	0,088	0,403	N/A	N/A
16th	0,004	0,017	0,003	0,013	N/A	N/A
17th	0,039	0,179	0,067	0,306	N/A	N/A
18th	0,003	0,015	0,003	0,013	N/A	N/A
19th	0,026	0,120	0,035	0,163	N/A	N/A
20th	0,003	0,014	0,002	0,011	N/A	N/A
21th	0,018	0,082	0,078	0,357	N/A	N/A
22th	0,003	0,012	0,002	0,011	N/A	N/A
23th	0,013	0,059	0,085	0,392	N/A	N/A
24th	0,003	0,013	0,003	0,013	N/A	N/A
25th	0,009	0,041	0,059	0,273	N/A	N/A
26th	0,003	0,012	0,002	0,011	N/A	N/A
27th	0,007	0,031	0,047	0,216	N/A	N/A
28th	0,003	0,012	0,002	0,009	N/A	N/A
29th	0,005	0,023	0,086	0,394	N/A	N/A
30th	0,002	0,010	0,002	0,010	N/A	N/A
31th	0,004	0,020	0,110	0,507	N/A	N/A
32th	0,002	0,008	0,002	0,011	N/A	N/A
33th	0,003	0,016	0,093	0,429	N/A	N/A
34th	0,002	0,007	0,002	0,010	N/A	N/A
35th	0,003	0,016	0,070	0,321	N/A	N/A
36th	0,002	0,007	0,002	0,010	N/A	N/A
37th	0,004	0,017	0,082	0,379	N/A	N/A
38th	0,002	0,007	0,003	0,012	N/A	N/A
39th	0,004	0,017	0,090	0,415	N/A	N/A
40th	0,002	0,011	0,003	0,012	N/A	N/A
THD_{40} [%]	--	2,958	--	2,718	23%	13%
PWHD [%]	--	1,571	--	8,535	23%	22%

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. CLUY-ESH-P23101056**

Power Quality. Harmonics.

ESY-4.6K

Generating Unit rating per phase (rpp)			4600 W			
	At 45-55% of rated output 2326 W		100% of rated output 4610 W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,075	0,343	0,058	0,268	8%	8%
3rd	0,309	1,420	0,651	2,993	21,6%	N/A
4th	0,023	0,108	0,007	0,033	4%	4%
5th	0,125	0,576	0,107	0,492	10,7%	10,7%
6th	0,022	0,103	0,015	0,067	2,67%	2,67%
7th	0,103	0,472	0,161	0,739	7,2%	7,2%
8th	0,023	0,107	0,008	0,039	2%	2%
9th	0,077	0,352	0,041	0,190	3,8%	N/A
10th	0,018	0,085	0,014	0,066	1,6%	1,6%
11th	0,046	0,211	0,083	0,381	3,1%	3,1%
12th	0,021	0,097	0,018	0,082	1,33%	1,33%
13th	0,144	0,661	0,220	1,010	2%	2%
14th	0,013	0,059	0,024	0,109	N/A	N/A
15th	0,086	0,394	0,126	0,579	N/A	N/A
16th	0,009	0,041	0,020	0,092	N/A	N/A
17th	0,059	0,272	0,095	0,436	N/A	N/A
18th	0,010	0,046	0,019	0,087	N/A	N/A
19th	0,041	0,189	0,067	0,307	N/A	N/A
20th	0,007	0,034	0,013	0,059	N/A	N/A
21th	0,027	0,126	0,058	0,267	N/A	N/A
22th	0,006	0,027	0,006	0,028	N/A	N/A
23th	0,021	0,095	0,045	0,208	N/A	N/A
24th	0,005	0,022	0,006	0,026	N/A	N/A
25th	0,016	0,072	0,039	0,178	N/A	N/A
26th	0,006	0,028	0,004	0,019	N/A	N/A
27th	0,012	0,053	0,032	0,147	N/A	N/A
28th	0,004	0,020	0,006	0,026	N/A	N/A
29th	0,009	0,040	0,027	0,124	N/A	N/A
30th	0,003	0,015	0,004	0,018	N/A	N/A
31th	0,006	0,029	0,022	0,103	N/A	N/A
32th	0,003	0,014	0,005	0,022	N/A	N/A
33th	0,005	0,023	0,018	0,085	N/A	N/A
34th	0,004	0,020	0,003	0,016	N/A	N/A
35th	0,005	0,021	0,016	0,072	N/A	N/A
36th	0,003	0,012	0,002	0,011	N/A	N/A
37th	0,003	0,014	0,013	0,060	N/A	N/A
38th	0,004	0,018	0,002	0,010	N/A	N/A
39th	0,004	0,017	0,013	0,059	N/A	N/A
40th	0,004	0,020	0,007	0,032	N/A	N/A
THD_{40} [%]	--	4,172	--	3,754	23%	13%
PWHD [%]	--	2,547	--	4,399	23%	22%

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 — **Nr. CLUY-ESH-P23101056**

Power Quality. Harmonics.

ESY-4K

Generating Unit rating per phase (rpp)			4000 W			
	At 45-55% of rated output 2020 W		100% of rated output 4028 W			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,054	0,248	0,033	0,152	8%	8%
3rd	0,287	1,320	0,699	3,214	21,6%	N/A
4th	0,018	0,081	0,007	0,031	4%	4%
5th	0,069	0,318	0,155	0,713	10,7%	10,7%
6th	0,014	0,064	0,006	0,026	2,67%	2,67%
7th	0,112	0,514	0,153	0,704	7,2%	7,2%
8th	0,014	0,066	0,012	0,057	2%	2%
9th	0,073	0,336	0,012	0,053	3,8%	N/A
10th	0,011	0,051	0,011	0,050	1,6%	1,6%
11th	0,037	0,171	0,079	0,362	3,1%	3,1%
12th	0,015	0,071	0,010	0,045	1,33%	1,33%
13th	0,137	0,630	0,200	0,921	2%	2%
14th	0,010	0,046	0,011	0,052	N/A	N/A
15th	0,081	0,373	0,110	0,505	N/A	N/A
16th	0,008	0,036	0,007	0,033	N/A	N/A
17th	0,056	0,257	0,082	0,378	N/A	N/A
18th	0,006	0,026	0,008	0,038	N/A	N/A
19th	0,038	0,174	0,063	0,288	N/A	N/A
20th	0,006	0,027	0,005	0,025	N/A	N/A
21th	0,029	0,134	0,050	0,228	N/A	N/A
22th	0,003	0,016	0,007	0,032	N/A	N/A
23th	0,021	0,095	0,039	0,180	N/A	N/A
24th	0,004	0,020	0,011	0,051	N/A	N/A
25th	0,016	0,072	0,035	0,160	N/A	N/A
26th	0,004	0,017	0,011	0,052	N/A	N/A
27th	0,012	0,053	0,028	0,127	N/A	N/A
28th	0,003	0,014	0,007	0,032	N/A	N/A
29th	0,009	0,042	0,022	0,101	N/A	N/A
30th	0,003	0,014	0,008	0,038	N/A	N/A
31th	0,007	0,032	0,019	0,087	N/A	N/A
32th	0,003	0,014	0,005	0,021	N/A	N/A
33th	0,006	0,028	0,016	0,074	N/A	N/A
34th	0,002	0,011	0,003	0,015	N/A	N/A
35th	0,006	0,026	0,013	0,058	N/A	N/A
36th	0,003	0,012	0,005	0,024	N/A	N/A
37th	0,006	0,029	0,013	0,062	N/A	N/A
38th	0,003	0,013	0,004	0,019	N/A	N/A
39th	0,005	0,025	0,009	0,040	N/A	N/A
40th	0,004	0,017	0,003	0,013	N/A	N/A
THD_{40} [%]	--	2,171	--	4,510	23%	13%
PWHD [%]	--	2,815	--	4,420	23%	22%

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

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%	0,9902	0,9885	0,9839	
50%	0,9991	0,9990	0,9983	
75%	0,9995	0,9994	0,9993	
100%	0,9999	0,9993	0,9993	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			**Stopping**			**Running**	
	dmax	**dc**	**d(t)**	**dmax**	**dc**	**d(t)**	**Pst**	**Plt 2 hours**
Measured values at test impedance	0,38	0,12	0,00	0,16	0,04	0,00	0,07	0,05
Measured values at standard impedance	0,38	0,12	0,00	0,16	0,04	0,00	0,07	0,05
Values for maximum impedance	0,38	0,12	0,00	0,16	0,04	0,00	0,07	0,05
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

Test impedance	R	0,400	Ω	Xl	0,250	Ω
	Z	0,472	Ω			
Standard impedance	R	0,400	Ω	Xl	0,250	Ω
	Z	0,472	Ω			
Maximum impedance	R	0,400	Ω	Xl	0,250	Ω
	Zmax	0,472	Ω			

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

Power Quality. DC injection.

ESY-4K

Test level power [%]	10	55	100
Recorded value [mA]	40	39	40
Recorded value [%]	0,23	0,22	0,23
Limit [%]	0,25	0,25	0,25

Note. Informative measurement of DC-injection of each phase of the inverter and a limit of 0,25% per phase of the rated current per phase as pass criteria.

Sum of all Phases

Tests are carried out at three defined power levels ±5%. At 230 V a 4 kW three phase Inverter has a current output of 17,39 A so DC limit is 43 mA. These tests is undertaken in accordance with Annex A.7.1.4.4.

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%.

ESY-8K

Test level power [%]	10	55	100
Recorded value [mA]	80	72	70
Recorded value [%]	0,23	0,21	0,20
Limit [%]	0,25	0,25	0,25

Note. Informative measurement of DC-injection of each phase of the inverter and a limit of 0,25% per phase of the rated current per phase as pass criteria.

Sum of all Phases

Tests are carried out at three defined power levels ±5%. At 230 V a 6 kW three phase Inverter has a current output of 26,09 A so DC limit is 65 mA. These tests is undertaken in accordance with Annex A.7.1.4.4.

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%.

Compliance Verification Report for Inverter Connected Power Generating Modules	
Extract from test report according to the Engineering Recommendation G99	**Nr. CLUY-ESH-P23101056**

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	20ms	144,9	23,30
Initial Value of aperiodic current	A	N/A	100ms	N/A	N/A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	N/A	N/A
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	N/A	N/A
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,006	
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 Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.	N/A
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 0124-100).	

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, see test report.	

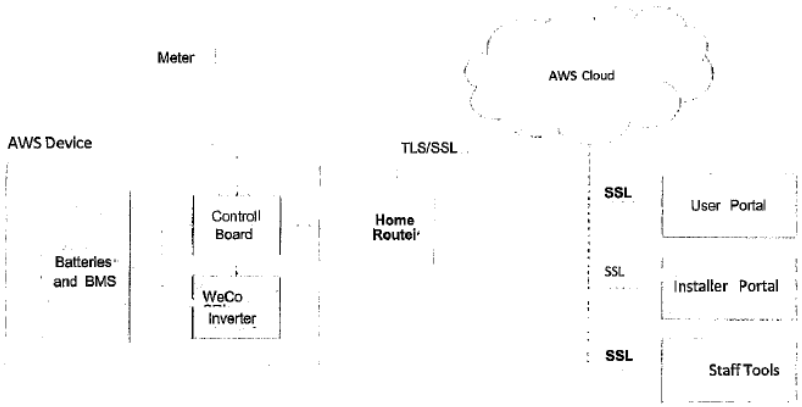
Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

WeCo Manufacturer's Declaration ETSI EN 303645 for G98-6 and G99-8

In accordance with the Cyber Security requirements of -G98-Amd.6(2021-09)standard Sec.s 9.7.1, 9.7.2,-G99-Amd.8(2021-09)standard Sec.s 9.1.7,9.1.8,WeCo SRL makes the following declaration:

1) WeCo SRL is a inverter manufacturer. Amazon Web Services (AWS) is a cloud service provider.By using WeCo SRL's inverter,AWS ESS's operation involves the following internal and external logic communications:



where the main components involved and their main functions are explained in the following table:

Name	Function	Location
Batteries and BMS	Monitoring of cells'status, execution of commands within safety conditions	AWS Device
WeCo SRL's Inverter	Power distribution to and from batteries	AWS Device
Control Board	Firmware resides here. Performs operating logic and safety requirements	AWS Device(PCB)
Meter(External Power Meter)	Current clamp or digital metering of house power	Customer Residence
Home Router	Gateway to internet connected by ethernet or WiFi extender	Customer Residence
User Portal	Web app for customer to access device information	AWS Cloud
Installer Portal	Web app for installers to record,monitor and verify installations	AWS Cloud
Staff Tools	Web apps and SSH terminal for staff to manage devices	AWS Cloud

and the subjects/parties involved in communications with the AWS BESS are listed in the following table, together with the purposes of the respective communications:

Subjectl Party	Means and devices	Operations
Final user	Web app	Monitoring of device and setting of operational modes firmware updates
AWS Staff	Web app,SSH terminal and telemetry data stream	Reading of diagnostics telemetry,remote management of device and firmware updates
Installers	Web app	Reading of diagnostics telemetry via local network only,running of automated tests and submission of installation documents
Partner	Cloud interface	Interfacing with Powervault's cloud via authenticated data stream or API for the retrieval of telemetry and dispatching of operational modes

2) All communications between internal components of the BESS,and between the device and supplied External Power Meter(s),take place via appropriate serial lines (RS485,CanBus,USB)and are not directly connected to any external device or system.

3)The only communication port between the BESS and the outside is constituted by the Gateway layer (GW)of a control board;the communication between the BESS and the outside world can take place via an Ethernet line,WiFi or GPRS router according to the customer's request.

A AWS BESS is a not-constrained customer IoT device according to the definitions in ETSI EN 303645 sec. 3.1.

4)The direct recipients/senders of communications with the BESS are in all cases the in-cloud server of AWS where the communication is made secure by the use of TSL (Transport Layer Security)technology on ATN 90x GW,and by the use of SSL (Secure Sockets Layer)technology on Final User's device side and Installer/AWS service web-tools side.

5)All communications between the AWS in-cloud server and the subjects/parties are cyber-protected by SSL technology.

6)The cyber-security assessment of the AWS BESSs was performed according to the ETSI EN 303645 standard,and it is reported according to the Table B.1 form of the same standard:

Table B.1 EN 303645 V2.1.1 (2020-06):Implementation of provisions for consumer IoT security

Clause Number and title			
Reference	**Status**	**Support**	**Detail**
5.1 No universal default passwords			
Provision 5.1-1	MC(1)	Y	
Provision 5.1-2	MC(2)	Y	
Provision 5.1-3	M	Y	
Provision 5.1-4	MC(8)	Y	
Provision 5.1-5	MC(5)	Y	
5.2 Implement a means to manage reports of vulnerabilities			
Provision 5.2-1	M	Y	
Provision 5.2-2	R	Y	
Provision 5.2-3	R	Y	
Keep software updated			
Provision 5.3-1	R	Y	
Provision 5.3-2	MC(5)	Y	
Provision 5.3-3	MC(12)	N/A	No update mechanism is performed by end user.
Provision 5.3-4	RC(12)	Y	
Provision 5.3-5	RC(12)	N/A	Updates are pushed,not pulled
Provision 5.3-6	RC(9,12)	N/A	Updates are pushed,not pulled
Provision 5.3-7	MC(12)	Y	
Provision 5.3-8	MC(12)	Y	
Provision 5.3-9	RC(12)	Y	
Provision 5.3-10	M(11,12)	Y	
Provision 5.3-11	RC(12)	N/A	All recommended updates are continuously pushed to device
Provision 5.3-12	RC(12)	Y	
Provision 5.3-13	M	Y	
Provision 5.3-14	RC(3,4)	N/A	Not a constrained device.
Provision 5.3-15	RC(3,4)	N/A	Not a constrained device.
Provision 5.3-16	M	Y	
5.4 Securely store sensitive security parameters			
Provision 5.4-1	M	Y	
Provision 5.4-2	MC(10)	Y	
Provision 5.4-3	M	Y	
Provision 5.4-4	M	Y	
5.5 Communicate securely			
Provision 5.5-1	M	Y	
Provision 5.5-2	R	Y	
Provision 5.5-3	R	Y	
Provision 5.5-4	R	Y	
Provision 5.5-5	M	Y	
Provision 5.5-6	R	Y	
Provision 5.5-7	M	Y	
Provision 5.5-8	M	Y	

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

5.6 Minimize exposed attack surfaces			
Provision 5.6-1	M	Y	Provision 5.6-1
Provision 5.6-2	M	Y	
Provision 5.6-3	R	Y	
Provision 5.6-4	MC(13)	N/A	No debug port accessible.
Provision 5.6-5	R	Y	
Provision 5.6-6	R	Y	
Provision 5.6-7	R	Y	
Provision 5.6-8	R	Y	
Provision 5.6-9	R	Y	
5.7 Ensure software integrity			
Provision 5.7-1	R	Y	
Provision 5.7-2	R	Y	
5.8 Ensure that personal data is secure			
Provision 5.8-1	R	Y	
Provision 5.8-2	M	Y	
Provision 5.8-3	M	Y	
5.9 Make systems resilient to outages			
Provision 5.9-1	R	Y	
Provision 5.9-2	R	Y	
Provision 5.9-3	R	Y	
5.10 Examine system telemetry data			
Provision 5.10-1	RC(6)	Y	
5.11 Make it easy for users to delete user data			
Provision 5.11-1	M	Y	No user/personal data are stored on device
Provision 5.11-2	R	N/A	No user/personal data are stored in the BESS
Provision 5.11-3	R	Y	
Provision 5.11-4	R	Y	
5.12 Make installation and maintenance of devices easy			
Provision 5.12-1	R	N/A	No installation/maintenance operations are available to the final user.
Provision 5.12-2	R	N/A	No installation/maintenance operations are available to the final user
Provision 5.12-3	R	N/A	See above two points.
5.13 Validate input data			
Provision 5.13-1	M	Y	
6 Data protection provisions for consumer IoT			
Provision 6.1	M	Y	
Provision 6.2	MC(7)	Y	
Provision 6.3	M	Y	
Provision 6.4	RC(6)	Y	
Provision 6.5	MC(6)	Y	
Conditions			
1)Passwords are used; 2)Pre-installed passwords are used 3)Software components are non-updateable 4)The device is constrained;			

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 | **Nr. CLUY-ESH-P23101056**

5)The device is not constrained; 6)Telemetry data being collected; 7)Personal data is processed on the basis of consumers' consent; 8)The device allows user authentication; 9)The device supports automatic updated and/or update notifications; 10)A hard-code unique per device identity is used for security purposes; 11)Updates are delivered over a network interface; 12)An update mechanism is implemented; 13)A debug interface is physically accessible.
Status Column uses the following notations: M:Mandatory provision R:Recommended provision M C:Mandatory and conditional provision R C:Recommended and conditional provision
Support Column uses the following notations Y:Supported N:Not supported N/A:Not applicable

WeCo srl a Socio Unico
Viale J.F. Kennedy, 113
50038 – Scarperia e S. Piero (FI)
Piva IT06567530487
C.F. 06567530487
Cod. dest. M5UXCR1
Applicant

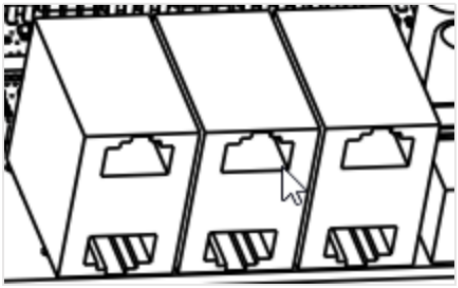
Wiring functional tests if required by para. 15.2.1	**N/A**
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning).	N/A
The inverter was tested in a test laboratory. The correct wiring functional test in the field has to be done by the responsible person for the installation of the plant.	

Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. CLUY-ESH-P23101056**

Logic Interface (input port) Required by paragraph 11.1.3.1	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 11.1.3.1 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



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.

