TÜV SÜD
Product Service

Certificate of Conformity

No. ESY 119210 0015 Rev. 00

Holder of Certificate: **Senmarck Energy Ltd**
2F Building 5A, Tusincere Park, No. 333 Longfei Rd
Longgang District
518100 Shenzhen
PEOPLE'S REPUBLIC OF CHINA

Product: **Converter**
(Hybrid Inverter)

Model(s): **Guard Plus-8KH3, Guard Plus-10KH3,**
Guard Plus-12KH3

Parameters: See page 2

Applicable standards: VDE-AR-N 4105:2018
DIN VDE V 0124-100 (VDE V 0124-100):2020

This Certificate of Conformity confirms the compliance with the above listed standards on a voluntary basis. It refers only to the sample submitted to TÜV SÜD Product Service GmbH and does not certify the quality or safety of the serial products. It was issued according to TÜV SÜD Product Service certification program Photovoltaics and Grid Integration. For details see: www.tuvsud.com/ps-cert

Test report no.: 64290233064601

Date, 2023-05-15

(Billy Qiu)

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D-ZE-11321-01-00

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Parameters:

Model:	Guard Plus-8KH3	Guard Plus-10KH3	Guard Plus-12KH3
PV input parameter			
Maximum input voltage	1100 Vd.c.		
MPPT voltage range	140~1000 Vd.c.		
MPPT voltage range (full load)	380~850 Vd.c.	420~850 Vd.c.	480~850 Vd.c.
Maximum input current	2*15 Ad.c.		
PV I_{SC}	2*20 Ad.c.		
Battery input/output parameter			
Battery type	Lithium or lead-acid		
Input voltage range	44~58 Vd.c.		
Maximum input/output voltage	58 Vd.c.		
Maximum charging current	160 Ad.c.		
Maximum charging power	8000 W		
Maximum discharging current	160 Ad.c.	200 Ad.c.	
Maximum discharging power	8000 W	10000 W	
Grid parameter			
Rated input/output voltage	3/N/PE, 230/400 Va.c.		
Rated input/output frequency	50 Hz		
Maximum input current	25 Aa.c.		
Maximum input active power	16000 W	17800 W	
Maximum input apparent power	16000 VA	17800 VA	
Maximum input active power from grid to battery	8600 W		
Rated output current	11.6 Aa.c.	14.5 Aa.c.	17.4 Aa.c.
Maximum continuous output current	12.8 Aa.c.	16.0 Aa.c.	19.2 Aa.c.
Rated output active power	8000 W	10000 W	12000 W
Maximum output active power	8000 W	10000 W	12000 W
Maximum output apparent power	8800 VA	11000 VA	13200 VA
Maximum active power P_{Emax}	8082 W	10124 W	12026 W
Maximum active power S_{Emax}	8890 VA	11130 VA	13277 VA
Maximum output active power from battery to grid (without PV input)	7500 W	9300 W	
Power factor	0.9 inductive(under-excited) to 0.9 capacitive(over-excited)		

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E.4 Unit certificate		
Manufacturer	Senmarck Energy Ltd	
Power generation unit type	[Converter]: GUARD PLUS-8KH3, GUARD PLUS-10KH3, GUARD PLUS-12KH3 Remark: certified on representative model GUARD PLUS-12KH3 of family design products, results of the measurement of GUARD PLUS-12KH3 can be transferred to other models based on transferability rule of measurements in DIN VDE V 0124-100 (VDE V 0124-100):2020.	
Assessment values	max. active power P_{Emax}	8082 W (GUARD PLUS-8KH3) 10124 W (GUARD PLUS-10KH3) 12026 W (GUARD PLUS-12KH3)
	max. apparent power S_{Emax}	8890 VA (GUARD PLUS-8KH3) 11130 VA (GUARD PLUS-10KH3) 13277 VA (GUARD PLUS-12KH3)
	Rated voltage	3/N/PE~, 230/400 Va.c.
	Rated current (AC) I_r	17.4 Aa.c. (GUARD PLUS-12KH3)
	Initial short-circuit AC current I''_k	17.4 Aa.c. (GUARD PLUS-12KH3)
Network connection rule	**VDE-AR-N 4105 "Generators connected to the low-voltage distribution network"** Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Test requirement	**DIN VDE V 0124-100 (VDE V 0124-100) "Network integration of power generation systems – Low voltage"** Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network	
Test report	64.290.23.30646.01 from 2023-05-04	
The above designated power generation unit meets the requirements of VDE-AR-N 4105.		

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E.5   Test report "Network interactions" for power generation units with an input current > 75 A

Extract of the test report for power generation units		
"Determination of electrical properties"		
System manufacturer:	Senmarck Energy Ltd 2F Building 5A, Tusincere Park, No. 333 Longfei Rd Longgang District 518100 Shenzhen PEOPLE'S REPUBLIC OF CHINA	
Manufacturer indications:	Type of system	Hybrid inverter for PV systems
	Max. active power P_{Emax}	8082 W (GUARD PLUS-8KH3) 10124 W (GUARD PLUS-10KH3) 12026 W (GUARD PLUS-12KH3)
	Rated voltage	3/N/PE~, 230/400 Va.c.
Measurement period:	From 2022-10-25 to 2023-02-13	

Rapid voltage changes	
Model	GUARD PLUS-10KH3
Connection without provisions (regarding the primary energy carrier)	K_i=0.50
Most adverse case when switching between generator levels	K_i=0.50
Connection at nominal conditions (of the primary energy carrier)	K_i=1.02
Disconnection at rated power	K_i=1.02
Worst value of all switching operations	k_{imax}=1.02

Rapid voltage changes	
Model	GUARD PLUS-12KH3
Connection without provisions (regarding the primary energy carrier)	K_i=0.50
Most adverse case when switching between generator levels	K_i=0.52
Connection at nominal conditions (of the primary energy carrier)	K_i=1.02
Disconnection at rated power	K_i=1.02
Worst value of all switching operations	k_{imax}=1.02

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Flicker–DIN EN 61000-3-3 (GUARD PLUS-10KH3)								
	Starting			Stopping			Running	
Test items	d_{max}(%)	d_c(%)	$d_{(t)}$ (%)	d_{max}(%)	d_c(%)	$d_{(t)}$ (%)	P_{st}	P_{lt} 2 hours
Limit value	4%	3.3%	3.3% 500ms	4%	3.3%	3.3% 500ms	1.0	0.65
L1	0	0	0	0	0	0	0.199	0.111
L2	0	0	0	0	0	0	0.181	0.109
L3	0	0	0	0	0	0	0.200	0.113

Flicker–DIN EN 61000-3-11 (GUARD PLUS-12KH3)					
Simulated network frequency (Hz)	50 Hz		Short circuit power Sk (VA)	435600	
Plt (Maximum measured Pst)	0.080/0.127/0.080		EZE nominal power Pn (W)	12000	
Maximum flicker coefficient Cφk	2.640/4.191/2.640		--	--	

Pst	#1	#2	#3	#4	#5	#6
L1	0.080	0.065	0.065	0.065	0.065	0.065
L2	0.127	0.068	0.068	0.069	0.068	0.068
L3	0.080	0.066	0.066	0.066	0.066	0.066
Pst	#7	#8	#9	#10	#11	#12
L1	0.065	0.066	0.065	0.065	0.065	0.065
L2	0.068	0.068	0.068	0.068	0.068	0.068
L3	0.066	0.066	0.066	0.066	0.066	0.066

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Harmonics-DIN EN 61000-3-2(≤16 A) (GUARD PLUS-10KH3)												
Phase L1												
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit value
Ordinal number	A	A	A	A	A	A	A	A	A	A	A	A
0	0.006	0.028	0.029	0.018	0.019	0.022	0.028	0.025	0.026	0.027	0.027	0.073
1	1.083	1.447	2.898	4.344	5.792	7.235	8.702	10.127	11.560	13.171	14.600	-
2	0.064	0.095	0.094	0.068	0.063	0.077	0.143	0.097	0.078	0.066	0.071	1.080
3	0.026	0.049	0.078	0.105	0.112	0.162	0.206	0.261	0.231	0.196	0.161	2.300
4	0.070	0.130	0.199	0.229	0.213	0.241	0.222	0.273	0.230	0.201	0.189	0.430
5	0.080	0.081	0.102	0.130	0.143	0.165	0.170	0.211	0.223	0.223	0.229	1.140
6	0.010	0.013	0.010	0.015	0.014	0.018	0.020	0.020	0.022	0.019	0.016	0.300
7	0.066	0.069	0.056	0.073	0.070	0.067	0.046	0.074	0.080	0.098	0.101	0.770
8	0.019	0.023	0.025	0.016	0.016	0.009	0.024	0.013	0.017	0.021	0.023	0.230
9	0.007	0.005	0.010	0.010	0.010	0.008	0.013	0.007	0.007	0.008	0.009	0.400
10	0.030	0.006	0.014	0.019	0.014	0.007	0.016	0.013	0.017	0.020	0.022	0.184
11	0.068	0.035	0.095	0.027	0.056	0.078	0.098	0.083	0.071	0.050	0.039	0.330
12	0.010	0.005	0.007	0.008	0.009	0.007	0.013	0.008	0.006	0.005	0.006	0.153
13	0.051	0.050	0.066	0.056	0.030	0.055	0.075	0.075	0.069	0.046	0.028	0.210
14	0.010	0.008	0.006	0.007	0.011	0.012	0.011	0.009	0.009	0.011	0.015	0.131
15	0.005	0.009	0.007	0.009	0.009	0.005	0.006	0.004	0.006	0.006	0.006	0.150
16	0.007	0.005	0.010	0.006	0.011	0.010	0.006	0.012	0.014	0.012	0.013	0.115
17	0.024	0.029	0.025	0.058	0.031	0.031	0.040	0.046	0.053	0.043	0.031	0.132
18	0.011	0.003	0.004	0.004	0.007	0.008	0.005	0.005	0.007	0.007	0.005	0.102
19	0.008	0.010	0.021	0.049	0.033	0.018	0.032	0.034	0.037	0.025	0.015	0.118
20	0.004	0.007	0.009	0.007	0.004	0.009	0.006	0.006	0.007	0.008	0.008	0.092
21	0.004	0.004	0.005	0.005	0.005	0.004	0.004	0.005	0.006	0.004	0.006	0.107
22	0.007	0.005	0.005	0.008	0.003	0.007	0.005	0.005	0.007	0.007	0.007	0.084
23	0.016	0.026	0.021	0.019	0.028	0.020	0.018	0.022	0.027	0.019	0.010	0.098
24	0.008	0.003	0.003	0.004	0.004	0.006	0.005	0.003	0.004	0.006	0.005	0.077
25	0.010	0.010	0.016	0.016	0.031	0.024	0.018	0.027	0.033	0.023	0.013	0.090
26	0.005	0.004	0.005	0.007	0.006	0.004	0.007	0.005	0.005	0.007	0.008	0.071
27	0.005	0.003	0.005	0.005	0.006	0.005	0.005	0.008	0.008	0.012	0.013	0.083
28	0.007	0.005	0.008	0.006	0.010	0.005	0.007	0.005	0.005	0.007	0.009	0.066
29	0.020	0.017	0.011	0.026	0.024	0.026	0.016	0.020	0.031	0.027	0.019	0.078
30	0.010	0.003	0.003	0.002	0.006	0.004	0.003	0.006	0.003	0.003	0.004	0.061
31	0.011	0.016	0.016	0.026	0.020	0.026	0.012	0.014	0.024	0.020	0.012	0.073
32	0.004	0.003	0.002	0.004	0.009	0.004	0.003	0.005	0.006	0.009	0.012	0.058
33	0.003	0.004	0.004	0.003	0.007	0.004	0.005	0.009	0.005	0.014	0.015	0.068
34	0.005	0.003	0.002	0.006	0.006	0.006	0.008	0.004	0.006	0.008	0.012	0.054
35	0.010	0.010	0.018	0.020	0.016	0.014	0.014	0.011	0.015	0.017	0.012	0.064
36	0.004	0.002	0.002	0.003	0.004	0.005	0.010	0.016	0.011	0.008	0.006	0.051
37	0.005	0.014	0.009	0.014	0.018	0.022	0.023	0.027	0.027	0.028	0.024	0.061
38	0.003	0.004	0.004	0.009	0.004	0.008	0.008	0.008	0.007	0.016	0.016	0.048
39	0.003	0.003	0.003	0.005	0.009	0.012	0.013	0.029	0.024	0.018	0.044	0.058
40	0.004	0.004	0.003	0.005	0.004	0.009	0.011	0.004	0.005	0.007	0.011	0.046
THD(%)	1.223	1.500	2.015	2.227	2.165	2.549	2.808	3.261	2.997	2.720	2.576	5%
Phase L2												

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Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit value
Ordinal number	A	A	A	A	A	A	A	A	A	A	A	A
0	0.015	0.014	0.002	0.020	0.018	0.027	0.061	0.006	0.010	0.002	0.003	0.073
1	1.078	1.433	2.880	4.320	5.760	7.197	8.623	10.088	11.525	13.134	14.563	-
2	0.058	0.097	0.086	0.067	0.074	0.073	0.082	0.097	0.081	0.066	0.067	1.080
3	0.014	0.036	0.068	0.087	0.100	0.164	0.198	0.202	0.169	0.126	0.103	2.300
4	0.055	0.139	0.177	0.210	0.188	0.204	0.206	0.207	0.167	0.136	0.133	0.430
5	0.089	0.072	0.049	0.036	0.043	0.053	0.064	0.096	0.105	0.158	0.182	1.140
6	0.011	0.012	0.009	0.011	0.015	0.014	0.022	0.013	0.015	0.013	0.016	0.300
7	0.061	0.065	0.063	0.073	0.076	0.081	0.075	0.083	0.084	0.099	0.104	0.770
8	0.012	0.020	0.027	0.023	0.021	0.022	0.015	0.023	0.027	0.027	0.026	0.230
9	0.007	0.007	0.008	0.012	0.014	0.013	0.012	0.010	0.011	0.011	0.012	0.400
10	0.022	0.006	0.008	0.019	0.016	0.019	0.013	0.015	0.019	0.023	0.024	0.184
11	0.080	0.042	0.098	0.028	0.060	0.092	0.108	0.093	0.078	0.052	0.037	0.330
12	0.010	0.003	0.003	0.004	0.005	0.004	0.009	0.005	0.006	0.005	0.005	0.153
13	0.048	0.048	0.063	0.048	0.037	0.052	0.074	0.073	0.069	0.046	0.026	0.210
14	0.006	0.008	0.005	0.011	0.018	0.010	0.012	0.016	0.016	0.016	0.017	0.131
15	0.006	0.006	0.005	0.004	0.005	0.005	0.009	0.006	0.005	0.009	0.009	0.150
16	0.007	0.003	0.009	0.005	0.006	0.006	0.008	0.011	0.011	0.011	0.012	0.115
17	0.019	0.033	0.026	0.063	0.027	0.030	0.047	0.051	0.054	0.041	0.029	0.132
18	0.005	0.003	0.003	0.004	0.004	0.004	0.005	0.004	0.004	0.006	0.005	0.102
19	0.010	0.007	0.018	0.044	0.029	0.022	0.032	0.032	0.036	0.028	0.018	0.118
20	0.006	0.005	0.007	0.006	0.006	0.009	0.006	0.008	0.012	0.014	0.014	0.092
21	0.005	0.004	0.003	0.005	0.004	0.004	0.005	0.007	0.009	0.006	0.005	0.107
22	0.010	0.003	0.003	0.006	0.007	0.002	0.004	0.005	0.006	0.008	0.008	0.084
23	0.017	0.024	0.021	0.024	0.034	0.019	0.020	0.027	0.028	0.020	0.011	0.098
24	0.005	0.002	0.002	0.003	0.003	0.004	0.003	0.003	0.003	0.004	0.004	0.077
25	0.013	0.012	0.015	0.017	0.029	0.026	0.016	0.026	0.034	0.025	0.014	0.090
26	0.005	0.004	0.006	0.007	0.007	0.005	0.005	0.004	0.006	0.010	0.011	0.071
27	0.006	0.002	0.004	0.005	0.006	0.004	0.004	0.008	0.009	0.012	0.013	0.083
28	0.008	0.004	0.008	0.005	0.007	0.006	0.005	0.004	0.004	0.007	0.008	0.066
29	0.020	0.020	0.013	0.027	0.025	0.028	0.014	0.023	0.030	0.025	0.015	0.078
30	0.007	0.002	0.002	0.003	0.003	0.003	0.005	0.003	0.002	0.005	0.006	0.061
31	0.012	0.014	0.014	0.024	0.019	0.020	0.015	0.013	0.022	0.019	0.010	0.073
32	0.004	0.002	0.003	0.003	0.007	0.004	0.003	0.004	0.004	0.007	0.008	0.058
33	0.004	0.003	0.004	0.006	0.006	0.005	0.005	0.009	0.005	0.014	0.015	0.068
34	0.005	0.004	0.002	0.003	0.003	0.003	0.005	0.004	0.004	0.009	0.011	0.054
35	0.009	0.009	0.016	0.021	0.013	0.018	0.016	0.012	0.020	0.015	0.005	0.064
36	0.004	0.003	0.002	0.006	0.005	0.009	0.008	0.016	0.007	0.005	0.004	0.051
37	0.004	0.010	0.009	0.016	0.018	0.023	0.032	0.026	0.027	0.026	0.016	0.061
38	0.003	0.003	0.003	0.005	0.005	0.006	0.011	0.008	0.005	0.010	0.014	0.048
39	0.003	0.003	0.004	0.009	0.011	0.014	0.013	0.028	0.025	0.016	0.045	0.058
40	0.005	0.004	0.003	0.006	0.004	0.005	0.006	0.007	0.006	0.007	0.007	0.046
THD(%)	1.196	1.496	1.783	1.907	1.830	2.186	2.415	2.510	2.216	2.033	2.024	5%
Phase L3												
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit value

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0	0.010	0.013	0.027	0.038	0.037	0.050	0.036	0.033	0.028	0.027	0.032	0.073
1	1.092	1.450	2.900	4.350	5.798	7.246	8.683	10.123	11.555	13.167	14.596	-
2	0.053	0.093	0.087	0.070	0.072	0.085	0.073	0.100	0.078	0.065	0.070	1.080
3	0.017	0.032	0.051	0.085	0.100	0.127	0.163	0.166	0.158	0.157	0.138	2.300
4	0.054	0.119	0.180	0.188	0.161	0.183	0.183	0.220	0.185	0.151	0.138	0.430
5	0.072	0.063	0.107	0.115	0.118	0.125	0.118	0.136	0.129	0.099	0.093	1.140
6	0.006	0.009	0.010	0.015	0.016	0.026	0.012	0.018	0.021	0.019	0.021	0.300
7	0.064	0.069	0.060	0.069	0.071	0.073	0.074	0.092	0.095	0.107	0.108	0.770
8	0.011	0.020	0.016	0.016	0.026	0.025	0.018	0.021	0.019	0.019	0.024	0.230
9	0.010	0.006	0.006	0.008	0.009	0.015	0.026	0.014	0.008	0.007	0.008	0.400
10	0.018	0.008	0.013	0.022	0.013	0.016	0.026	0.012	0.014	0.018	0.019	0.184
11	0.073	0.034	0.092	0.026	0.065	0.093	0.096	0.085	0.075	0.055	0.044	0.330
12	0.005	0.005	0.006	0.008	0.007	0.005	0.008	0.006	0.005	0.005	0.006	0.153
13	0.052	0.047	0.068	0.050	0.031	0.053	0.071	0.068	0.064	0.044	0.026	0.210
14	0.008	0.011	0.007	0.009	0.011	0.009	0.007	0.016	0.014	0.015	0.016	0.131
15	0.005	0.006	0.006	0.010	0.008	0.007	0.011	0.008	0.007	0.007	0.006	0.150
16	0.008	0.006	0.009	0.007	0.011	0.008	0.010	0.014	0.015	0.014	0.014	0.115
17	0.025	0.031	0.024	0.055	0.023	0.035	0.045	0.047	0.052	0.040	0.029	0.132
18	0.009	0.003	0.005	0.004	0.008	0.006	0.006	0.005	0.006	0.007	0.007	0.102
19	0.012	0.011	0.021	0.049	0.028	0.023	0.030	0.033	0.035	0.027	0.019	0.118
20	0.005	0.004	0.006	0.005	0.005	0.003	0.005	0.007	0.009	0.008	0.008	0.092
21	0.005	0.003	0.003	0.006	0.009	0.005	0.004	0.008	0.008	0.005	0.004	0.107
22	0.007	0.005	0.004	0.009	0.007	0.007	0.006	0.006	0.008	0.012	0.013	0.084
23	0.016	0.024	0.018	0.021	0.028	0.016	0.021	0.027	0.029	0.019	0.011	0.098
24	0.006	0.003	0.002	0.004	0.004	0.006	0.003	0.005	0.006	0.005	0.005	0.077
25	0.015	0.014	0.018	0.016	0.029	0.021	0.022	0.027	0.031	0.024	0.015	0.090
26	0.004	0.003	0.005	0.005	0.008	0.006	0.004	0.006	0.006	0.008	0.010	0.071
27	0.005	0.003	0.005	0.006	0.007	0.007	0.004	0.008	0.009	0.011	0.012	0.083
28	0.009	0.005	0.008	0.006	0.007	0.005	0.007	0.004	0.005	0.007	0.008	0.066
29	0.018	0.018	0.011	0.026	0.027	0.024	0.014	0.025	0.034	0.028	0.019	0.078
30	0.004	0.002	0.002	0.003	0.004	0.003	0.004	0.005	0.004	0.004	0.004	0.061
31	0.014	0.015	0.016	0.027	0.020	0.020	0.008	0.016	0.024	0.019	0.013	0.073
32	0.004	0.003	0.003	0.005	0.005	0.006	0.004	0.006	0.008	0.007	0.007	0.058
33	0.005	0.003	0.003	0.009	0.005	0.010	0.003	0.007	0.005	0.012	0.015	0.068
34	0.006	0.003	0.002	0.004	0.006	0.009	0.005	0.006	0.010	0.008	0.006	0.054
35	0.010	0.012	0.016	0.019	0.011	0.015	0.017	0.011	0.020	0.018	0.014	0.064
36	0.004	0.002	0.003	0.010	0.009	0.009	0.010	0.014	0.012	0.006	0.005	0.051
37	0.005	0.014	0.010	0.012	0.020	0.024	0.032	0.023	0.038	0.037	0.029	0.061
38	0.003	0.002	0.003	0.004	0.004	0.004	0.005	0.005	0.006	0.012	0.014	0.048
39	0.003	0.003	0.003	0.004	0.006	0.008	0.015	0.023	0.021	0.016	0.043	0.058
40	0.003	0.002	0.003	0.005	0.005	0.010	0.007	0.008	0.006	0.008	0.008	0.046
THD(%)	1.118	1.373	1.880	1.929	1.851	2.138	2.260	2.528	2.315	2.033	1.879	5%

Harmonics-DIN EN 61000-3-12(>16 A and ≤75 A) (GUARD PLUS-12KH3)											
Phase L1											
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit value
Ordinal number	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
0	0.069	0.177	0.185	0.110	0.166	0.211	0.397	0.467	0.258	0.253	0.249	0.5
1	1.216	10.427	19.746	30.081	39.382	49.693	59.983	70.206	80.394	90.589	100.811	-
2	0.240	0.315	0.294	0.216	0.309	0.291	0.357	0.321	0.211	0.311	0.487	8
3	0.144	0.211	1.769	0.325	0.344	0.844	0.761	0.768	0.796	0.740	0.644	21.6
4	0.170	0.781	0.592	0.611	0.649	0.640	0.387	0.396	0.467	0.667	0.813	4
5	0.467	0.490	1.125	0.605	0.785	1.097	0.967	0.615	0.620	0.471	0.600	10.7
6	0.046	0.064	0.050	0.045	0.144	0.167	0.244	0.229	0.164	0.179	0.143	2.67
7	0.349	0.365	0.084	0.226	0.268	0.357	0.422	0.400	0.378	0.306	0.408	7.2
8	0.068	0.072	0.112	0.068	0.049	0.088	0.168	0.182	0.164	0.149	0.102	2
9	0.123	0.024	0.056	0.077	0.072	0.070	0.054	0.054	0.058	0.086	0.108	3.8
10	0.076	0.027	0.018	0.069	0.04	0.061	0.115	0.125	0.136	0.127	0.100	1.6
11	0.283	0.437	0.423	0.293	0.462	0.549	0.447	0.440	0.390	0.338	0.324	3.1
12	0.036	0.020	0.023	0.020	0.016	0.031	0.083	0.103	0.093	0.108	0.102	1.33
13	0.268	0.137	0.319	0.130	0.315	0.405	0.395	0.391	0.315	0.219	0.141	2
14	0.041	0.027	0.016	0.046	0.03	0.042	0.062	0.067	0.082	0.093	0.086	-
15	0.042	0.043	0.085	0.041	0.051	0.038	0.049	0.038	0.028	0.034	0.052	-
16	0.040	0.034	0.024	0.038	0.03	0.025	0.060	0.059	0.066	0.066	0.071	-
17	0.138	0.249	0.258	0.141	0.193	0.241	0.255	0.312	0.277	0.196	0.114	-
18	0.028	0.017	0.011	0.018	0.02	0.011	0.035	0.043	0.036	0.048	0.054	-
19	0.159	0.202	0.154	0.182	0.09	0.187	0.187	0.219	0.192	0.129	0.075	-
20	0.020	0.012	0.026	0.016	0.023	0.022	0.041	0.042	0.045	0.044	0.038	-
21	0.033	0.018	0.108	0.023	0.02	0.024	0.034	0.027	0.021	0.027	0.026	-
22	0.028	0.017	0.013	0.019	0.013	0.011	0.035	0.038	0.048	0.048	0.039	-
23	0.069	0.072	0.073	0.158	0.085	0.109	0.139	0.157	0.143	0.096	0.057	-
24	0.019	0.020	0.017	0.012	0.021	0.013	0.031	0.031	0.028	0.033	0.033	-
25	0.074	0.117	0.042	0.178	0.108	0.112	0.172	0.202	0.182	0.123	0.075	-
26	0.022	0.032	0.014	0.032	0.029	0.011	0.041	0.044	0.052	0.051	0.046	-
27	0.033	0.029	0.047	0.036	0.031	0.014	0.034	0.041	0.070	0.069	0.059	-
28	0.024	0.015	0.013	0.031	0.015	0.010	0.025	0.028	0.045	0.057	0.057	-
29	0.071	0.072	0.118	0.142	0.112	0.085	0.142	0.173	0.175	0.141	0.100	-
30	0.018	0.011	0.007	0.011	0.014	0.017	0.022	0.020	0.031	0.045	0.049	-
31	0.093	0.068	0.077	0.103	0.104	0.038	0.095	0.126	0.132	0.098	0.063	-
32	0.013	0.011	0.015	0.026	0.018	0.011	0.017	0.027	0.044	0.065	0.057	-
33	0.016	0.020	0.108	0.022	0.021	0.017	0.029	0.022	0.039	0.077	0.084	-
34	0.014	0.012	0.013	0.022	0.018	0.014	0.016	0.023	0.030	0.063	0.064	-
35	0.019	0.102	0.101	0.055	0.088	0.079	0.082	0.113	0.101	0.069	0.051	-
36	0.010	0.010	0.016	0.012	0.011	0.021	0.020	0.017	0.016	0.049	0.061	-
37	0.049	0.085	0.033	0.130	0.168	0.175	0.170	0.211	0.205	0.150	0.097	-
38	0.012	0.009	0.015	0.026	0.015	0.027	0.027	0.031	0.023	0.066	0.077	-
39	0.022	0.039	0.029	0.095	0.059	0.038	0.088	0.073	0.074	0.097	0.045	-
40	0.012	0.015	0.011	0.040	0.023	0.022	0.027	0.040	0.019	0.052	0.075	-
THC/I_ref	0.843	1.228	2.303	1.117	1.343	1.795	1.637	1.481	1.437	1.364	1.465	13
PWHC /I_ref	1.352	1.859	1.911	2.163	1.908	2.025	2.434	2.897	2.766	2.310	1.797	22
Phase L2												

Certificate of Conformity

No. ESY 119210 0015 Rev. 00

Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit value
Ordinal number	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
0	0.215	0.083	0.126	0.204	0.162	0.134	0.068	0.018	0.053	0.062	0.118	0.5
1	1.151	10.370	19.750	30.088	39.405	49.701	60.012	70.298	80.507	90.718	100.924	-
2	0.236	0.288	0.224	0.260	0.314	0.296	0.315	0.266	0.242	0.408	0.511	8
3	0.080	0.220	3.542	0.390	0.431	1.067	1.141	1.092	0.971	0.800	0.722	21.6
4	0.182	0.785	0.753	0.787	0.758	0.629	0.466	0.330	0.146	0.294	0.475	4
5	0.452	0.341	0.554	0.395	0.504	0.921	1.153	1.100	1.077	1.127	1.349	10.7
6	0.041	0.039	0.053	0.047	0.065	0.068	0.104	0.137	0.108	0.155	0.141	2.67
7	0.321	0.378	0.594	0.384	0.367	0.419	0.525	0.512	0.509	0.468	0.561	7.2
8	0.070	0.019	0.037	0.072	0.080	0.071	0.154	0.140	0.099	0.088	0.068	2
9	0.106	0.038	0.442	0.112	0.090	0.083	0.105	0.099	0.091	0.102	0.103	3.8
10	0.090	0.038	0.075	0.079	0.040	0.040	0.078	0.105	0.098	0.093	0.072	1.6
11	0.326	0.463	0.215	0.252	0.458	0.571	0.493	0.494	0.405	0.360	0.367	3.1
12	0.041	0.018	0.052	0.014	0.019	0.019	0.046	0.033	0.030	0.039	0.039	1.33
13	0.243	0.124	0.307	0.125	0.269	0.421	0.426	0.379	0.288	0.173	0.071	2
14	0.044	0.021	0.037	0.039	0.026	0.043	0.057	0.064	0.062	0.067	0.058	-
15	0.057	0.037	0.110	0.058	0.054	0.042	0.042	0.046	0.047	0.037	0.029	-
16	0.056	0.040	0.029	0.049	0.035	0.027	0.039	0.039	0.053	0.051	0.066	-
17	0.148	0.263	0.314	0.188	0.158	0.247	0.270	0.338	0.282	0.192	0.102	-
18	0.024	0.018	0.016	0.018	0.017	0.013	0.023	0.033	0.023	0.024	0.031	-
19	0.172	0.197	0.161	0.192	0.083	0.186	0.178	0.230	0.192	0.120	0.052	-
20	0.015	0.020	0.018	0.017	0.018	0.015	0.033	0.032	0.039	0.040	0.035	-
21	0.022	0.017	0.076	0.035	0.045	0.029	0.050	0.060	0.027	0.026	0.036	-
22	0.017	0.023	0.019	0.017	0.031	0.015	0.024	0.024	0.027	0.020	0.018	-
23	0.099	0.092	0.110	0.171	0.105	0.092	0.141	0.173	0.148	0.099	0.066	-
24	0.022	0.020	0.019	0.017	0.016	0.014	0.023	0.019	0.015	0.014	0.015	-
25	0.074	0.122	0.067	0.156	0.130	0.090	0.171	0.194	0.167	0.109	0.059	-
26	0.031	0.034	0.026	0.035	0.025	0.011	0.033	0.030	0.024	0.028	0.029	-
27	0.033	0.038	0.054	0.050	0.039	0.043	0.042	0.044	0.059	0.051	0.043	-
28	0.024	0.015	0.025	0.030	0.023	0.012	0.021	0.021	0.032	0.021	0.024	-
29	0.070	0.078	0.141	0.125	0.139	0.078	0.130	0.192	0.175	0.116	0.059	-
30	0.019	0.012	0.014	0.010	0.013	0.013	0.017	0.017	0.014	0.014	0.015	-
31	0.093	0.064	0.089	0.094	0.112	0.058	0.082	0.134	0.124	0.076	0.037	-
32	0.016	0.015	0.016	0.022	0.016	0.013	0.019	0.019	0.017	0.018	0.019	-
33	0.029	0.025	0.101	0.042	0.024	0.036	0.032	0.032	0.042	0.068	0.063	-
34	0.012	0.012	0.013	0.018	0.013	0.027	0.019	0.020	0.029	0.028	0.024	-
35	0.027	0.101	0.109	0.074	0.090	0.073	0.068	0.108	0.118	0.081	0.063	-
36	0.012	0.015	0.010	0.016	0.013	0.022	0.017	0.014	0.014	0.018	0.018	-
37	0.049	0.078	0.037	0.107	0.133	0.151	0.168	0.179	0.184	0.149	0.103	-
38	0.010	0.010	0.026	0.011	0.027	0.016	0.021	0.018	0.017	0.013	0.015	-
39	0.035	0.049	0.079	0.051	0.056	0.019	0.046	0.049	0.062	0.083	0.051	-
40	0.010	0.018	0.015	0.018	0.029	0.031	0.027	0.031	0.031	0.047	0.043	-
THC/I$_{ref}$	0.834	1.189	3.794	1.198	1.298	1.825	1.983	1.911	1.737	1.657	1.841	13
PWHC/I$_{ref}$	1.474	1.921	2.224	2.101	1.891	1.928	2.334	2.892	2.649	1.979	1.323	22
Phase L3												
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit value

DAkkS
Deutsche
Akkreditierungsstelle
D-ZE-11321-01-00

TÜV SÜD
Product Service

Certificate of Conformity

No. ESY 119210 0015 Rev. 00

Ordinal number	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
0	0.309	0.287	0.338	0.339	0.351	0.367	0.485	0.466	0.324	0.321	0.370	0.5
1	1.225	10.431	19.748	30.162	39.484	49.817	60.117	70.372	80.617	90.816	100.983	-
2	0.249	0.257	0.186	0.267	0.335	0.295	0.264	0.360	0.287	0.384	0.461	8
3	0.075	0.269	3.158	0.415	0.448	1.135	0.868	0.680	0.441	0.264	0.338	21.6
4	0.132	0.737	0.629	0.711	0.752	0.738	0.669	0.558	0.460	0.397	0.409	4
5	0.331	0.443	1.215	0.320	0.398	0.309	0.444	0.861	1.021	1.071	1.146	10.7
6	0.033	0.061	0.071	0.055	0.119	0.122	0.204	0.192	0.121	0.125	0.177	2.67
7	0.328	0.329	0.638	0.335	0.388	0.449	0.502	0.460	0.439	0.425	0.506	7.2
8	0.060	0.068	0.089	0.069	0.053	0.042	0.091	0.120	0.079	0.074	0.056	2
9	0.038	0.024	0.426	0.046	0.065	0.062	0.083	0.082	0.062	0.083	0.101	3.8
10	0.036	0.020	0.075	0.051	0.057	0.036	0.078	0.075	0.059	0.053	0.044	1.6
11	0.222	0.450	0.463	0.264	0.513	0.585	0.484	0.443	0.384	0.322	0.312	3.1
12	0.045	0.016	0.071	0.020	0.024	0.032	0.051	0.082	0.072	0.076	0.071	1.33
13	0.288	0.122	0.359	0.152	0.268	0.378	0.394	0.380	0.276	0.150	0.087	2
14	0.039	0.026	0.028	0.050	0.032	0.034	0.034	0.028	0.045	0.045	0.043	-
15	0.031	0.034	0.083	0.036	0.031	0.030	0.039	0.055	0.055	0.062	0.061	-
16	0.052	0.028	0.031	0.044	0.035	0.019	0.040	0.051	0.039	0.032	0.052	-
17	0.147	0.252	0.123	0.148	0.169	0.258	0.272	0.317	0.252	0.156	0.078	-
18	0.021	0.022	0.017	0.026	0.026	0.013	0.034	0.030	0.027	0.031	0.038	-
19	0.181	0.192	0.176	0.166	0.101	0.173	0.165	0.213	0.177	0.103	0.049	-
20	0.015	0.018	0.013	0.015	0.028	0.013	0.027	0.033	0.028	0.023	0.020	-
21	0.016	0.016	0.058	0.037	0.014	0.022	0.035	0.030	0.033	0.062	0.072	-
22	0.018	0.014	0.011	0.012	0.023	0.020	0.024	0.023	0.029	0.027	0.023	-
23	0.070	0.076	0.079	0.172	0.066	0.115	0.159	0.170	0.138	0.073	0.038	-
24	0.022	0.020	0.017	0.023	0.023	0.015	0.025	0.027	0.018	0.015	0.017	-
25	0.085	0.126	0.086	0.166	0.113	0.102	0.160	0.197	0.161	0.088	0.040	-
26	0.029	0.033	0.020	0.035	0.024	0.013	0.033	0.031	0.028	0.020	0.016	-
27	0.031	0.024	0.040	0.031	0.033	0.012	0.035	0.042	0.056	0.034	0.052	-
28	0.020	0.014	0.017	0.029	0.016	0.018	0.026	0.026	0.017	0.016	0.026	-
29	0.066	0.076	0.045	0.119	0.127	0.062	0.144	0.190	0.177	0.114	0.038	-
30	0.013	0.009	0.014	0.011	0.020	0.015	0.019	0.019	0.016	0.020	0.013	-
31	0.104	0.067	0.154	0.112	0.092	0.049	0.083	0.130	0.126	0.079	0.048	-
32	0.013	0.012	0.010	0.033	0.012	0.013	0.023	0.029	0.021	0.016	0.012	-
33	0.018	0.009	0.026	0.016	0.026	0.011	0.028	0.027	0.025	0.051	0.045	-
34	0.016	0.012	0.013	0.021	0.013	0.016	0.029	0.033	0.022	0.016	0.012	-
35	0.017	0.101	0.057	0.049	0.088	0.064	0.072	0.110	0.107	0.073	0.066	-
36	0.016	0.012	0.010	0.012	0.017	0.014	0.021	0.029	0.015	0.024	0.023	-
37	0.058	0.078	0.061	0.104	0.160	0.175	0.161	0.195	0.186	0.140	0.063	-
38	0.014	0.013	0.014	0.019	0.019	0.024	0.026	0.039	0.039	0.025	0.016	-
39	0.012	0.017	0.027	0.081	0.046	0.030	0.063	0.063	0.057	0.078	0.040	-
40	0.012	0.011	0.016	0.027	0.032	0.037	0.034	0.045	0.037	0.042	0.028	-
THC/I_{ref}	0.735	1.170	3.598	1.113	1.294	1.701	1.551	1.615	1.496	1.409	1.507	13
PWHC /I_{ref}	1.453	1.834	1.607	2.037	1.841	1.988	2.347	2.880	2.539	1.779	1.106	22

Anmerkung: Iref = 17.4 A
THC und PWHC werden bis zu 40th berechnet.

Certificate of Conformity

No. ESY 119210 0015 Rev. 00

E.6 Certificate of the network and system protection

Certificate of NS protection		
Manufacturer	Senmarck Energy Ltd 2F Building 5A, Tusincere Park, No. 333 Longfei Rd Longgang District 518100 Shenzhen PEOPLE'S REPUBLIC OF CHINA	
Type of NS protection	Integrated NS protection	
Central NS protection	☐	
Integrated NS protection	☒	Assigned to power generation unit of type: GUARD PLUS-8KH3, GUARD PLUS-10KH3, GUARD PLUS-12KH3
Network connection rule	**VDE-AR-N 4105 "Generators connected to the low-voltage distribution network"** Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Test requirement	**DIN VDE V 0124-100 (VDE V 0124-100) "Network integration of power generation systems – Low voltage"** Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network	
Test report	64.290.23.30646.01 from 2023-05-04	
The network and system protection designated above meets the requirements of VDE-AR-N 4105.		

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E.7 Requirements for the test report for the NS protection

Extract from test report for NS protection		
"Determination of electrical properties"		
NS protection test report		
Type of NS system:	Integrated NS protection	**Other Manufacturer indications**
Software version:	A1	
Manufacturer:	Senmarck Energy Ltd 2F Building 5A, Tusincere Park, No. 333 Longfei Rd Longgang District 518100 Shenzhen PEOPLE'S REPUBLIC OF CHINA	
Measuring period:	From 2022-10-25 to 2023-02-13	

	Inverter		
Protection function	**Setting value**	**Tripping value**	**Tripping time NS protection***
Rise-in-voltage protection $U \gg$	$1.25 \,^* U_n$	L1-N/L2-N/L3-N: 287.28 V/287.23 V/287.33 V L1-N: 287.06 V L2-N: 286.09 V L3-N: 286.36 V	L1-N/L2-N/L3-N: 178.0 ms L1-N: 182.0 ms L2-N: 176.0 ms L3-N: 176.0 ms
Rise-in-voltage protection $U >$	$1.10 \,^* U_n$	$1.10 \,^* U_n$	ms**
Voltage drop protection $U <$	$0.8 \,^* U_n$	L1-N/L2-N/L3-N: 184.49 V/184.38 V/184.33 V L1-N: 184.51 V L2-N: 184.56 V L3-N: 184.33 V	L1-N/L2-N/L3-N: 3.076 s L1-N: 3.080 s L2-N: 3.080 s L3-N: 3.080 s
Voltage drop protection $U \ll$	$0.45 \,^* U_n$	L1-N/L2-N/L3-N: 103.64 V/103.90 V/103.70 V L1-N: 103.48 V L2-N: 104.44 V; L3-N: 103.64 V;	L1-N/L2-N/L3-N: 398 ms L1-N: 398 ms L2-N: 376 ms L3-N: 382 ms
Frequency decrease protection $f <$	47.5 Hz	47.50 Hz	120.0 ms
Frequency increase protection $f >$	51.5 Hz	51.50 Hz	108.0 ms

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*: 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.

**: Verification disconnection time of moving 10-min-average value.

Disconnecting time as below:

1. 487.4 s (from 600s@U_n to 112%U_n)
2. Continuous operation (from 600s@U_n to 108%U_n)
3. 332.8 s (from 600s@106%U_n to 114%U_n)

☑ as integrated NS protection	
Assigned to power generation unit type	GUARD PLUS-8KH3, GUARD PLUS-10KH3, GUARD PLUS-12KH3
Integrated interface switch type	Series-connected relays for all phase conductors each Manufacture: Churod Electronics Co., Ltd. Model: CHFN-V-112HA2F
Response time of interface switch for integrated NS protection	Release time: Max. 10 ms
Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.	☑