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

TÜV SÜD Product Service

Certificate of Conformity

No. ESY 123596 0003 Rev. 00

Holder of Certificate: **Solar.on Sun Technologies GmbH**
Portastraße 21
32545 Bad Oeynhausen
GERMANY

Product: **Converter**
Hybrid solar inverter

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.: 704092377001-00

Date, 2023-12-21

(Zhengdong Ma)

TÜV SÜD Product Service GmbH • Certification Body • Ridlerstraße 65 • 80339 Munich • Germany

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Certificate of Conformity

No. ESY 123596 0003 Rev. 00

Model(s): **SSG-12TL-ZH, SSG-10TL-ZH, SSG-8TL-ZH, SSG-6TL-ZH, SSG-5TL-ZH**

Parameters:

Please see pages 3 to 10.

Applicable standards:

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

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Model	SSG-12TL-ZH	SSG-10TL-ZH	SSG-8TL-ZH
PV input			
Max. input voltage	1000 Vd.c.		
MPPT voltage range	200, …, 900 Vd.c		
Max. input current	26/26 Ad.c.		
Max. short circuit current	32/32 Ad.c.		
AC output			
Rated voltage	3/N/PE~ 230/400 V		
Rated frequency	50 Hz		
Rated output power	12 kW	10 kW	8 kW
Max. apparent output power	12 kVA	10 kVA	8 kVA
Max. output current	17.3 Aa.c.	14.4 Aa.c.	11.5 Aa.c.
Power factor	0.8leading, ..., 1, ..., 0.8lagging		

Model	SSG-6TL-ZH	SSG-5TL-ZH
PV input		
Max. input voltage	1000 Vd.c.	
MPPT voltage range	200, …, 900 Vd.c	
Max. input current	16/16 Ad.c.	
Max. short circuit current	20/20 Ad.c.	
AC output		
Rated voltage	3/N/PE~ 230/400 V	
Rated frequency	50 Hz	
Rated output power	6 kW	5 kW
Max. apparent output power	6 kVA	5 kVA
Max. output current	8.7 Aa.c.	7.2 Aa.c.
Power factor	0.8leading, ..., 1, ..., 0.8lagging	

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E.4 Unit certificate

Unit certificate	No. 704092377001-00	
Manufacturer	Solar.on Sun Technologies GmbH Portastraße 21, 32545 Bad Oeynhausen, GERMANY	
Power generation unit type	[Inverter]: SSG-12TL-ZH, SSG-10TL-ZH, SSG-8TL-ZH, SSG-6TL-ZH, SSG-5TL-ZH Remark: certified on representative model SSG-12TL-ZH of family design products, results of the measurement of SSG-12TL-ZH can be transferred to the other models based on transferability rule of measurements in DIN VDE V 0124-100 (VDE V 0124-100):2020.	
☑ Inverter	☐ Asynchronous generator	☐ Synchronous generator
☐ Stirling generator	☐ Fuel cell	☐ others
Assessment values	Max. active power P_{Emax}	11.99 kW (for model SSG-12TL-ZH)
	Max. apparent power S_{Emax}	12.11 kVA (for model SSG-12TL-ZH)
	Rated voltage	3/N/PE~, 230/400 V
Rated values	Rated current (AC) I_r	7.2 A (for model SSG-5TL-ZH) 8.7A (for model SSG-6TL-ZH) 11.5 A (for model SSG-8TL-ZH) 14.4 A (for model SSG-10TL-ZH) 17.3 A (for model SSG-12TL-ZH)
Rated values	Initial short-circuit current I_k"	7.2 A (for model SSG-5TL-ZH) 8.7A (for model SSG-6TL-ZH) 11.5 A (for model SSG-8TL-ZH) 14.4 A (for model SSG-10TL-ZH) 17.3 A (for model SSG-12TL-ZH)
Network connection rules	**VDE-AR-N 4105:2018-11/Corrigendum 1:2020-10** Generators connected to the low-voltage distribution network - Technical requirements for the connection to and parallel operation with low-voltage distribution networks.	
Test requirement	**DIN VDE V 0124-100 (VDE V 0124-100):2020-06 "Network integration of power generation system – Low voltage"** Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network.	
The above-mentioned power generation unit meets the requirements of VDE-AR-N 4105.		

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No. ESY 123596 0003 Rev. 00

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

Extract from test report for unit certificate “Determination of electrical properties”		No. 704092377001-00
Generation unit manufacturer:	Solar.on Sun Technologies GmbH Portastraße 21, 32545 Bad Oeynhausen, GERMANY	
Manufacturer indications:	Type of system	Inverter for PV system
	Max. active power P_{Emax}	5000 W (for model SSG-5TL-ZH) 6000 W (for model SSG-6TL-ZH) 8000 W (for model SSG-8TL-ZH) 10000 W (for model SSG-10TL-ZH) 12000 W (for model SSG-12TL-ZH)
	Rated voltage	3/N/PE~, 230/400 V
Period of measurement:	From 2023-08-23 to 2023-09-18, 2023-12-13	

Flicker (EN 61000-3-11) (SSG-12TL-ZH)					
Test condition	$d_{(t)\ -\ 500ms}$ [%]	d_c [%]	d_{max} [%]	P_{st}	P_{lt}
Continuous operation	0/0/0	0.101/0.100/0.093	0.445/0.597/0.469	0.112/0.234/0.111	0.112/0.234/0.111
Start	0/0/0	0.082/0.092/0.090	0.460/0.432/0.426	-	-
Stop	0/0/0	0.325/0.360/0.270	0.375/0.409/0.320	-	-
Limit	3.3%	3.3%	4%	1.0	0.65

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Harmonics (IEC 61000-3-2 (≤ 16A))												
Power P/Pn[%]	0-5	10	20	30	40	50	60	70	80	90	100	Limit
Ordinal number	A	A	A	A	A	A	A	A	A	A	A	A
2	0.079	0.033	0.035	0.039	0.041	0.045	0.051	0.059	0.067	0.075	0.051	1.080
3	0.098	0.089	0.086	0.080	0.079	0.083	0.081	0.094	0.099	0.106	0.119	2.300
4	0.026	0.008	0.008	0.008	0.009	0.010	0.011	0.013	0.015	0.016	0.011	0.430
5	0.087	0.081	0.060	0.062	0.063	0.065	0.067	0.065	0.067	0.073	0.081	1.140
6	0.027	0.006	0.006	0.007	0.007	0.008	0.009	0.009	0.010	0.010	0.009	0.300
7	0.094	0.052	0.043	0.040	0.046	0.051	0.054	0.057	0.057	0.060	0.054	0.770
8	0.026	0.006	0.006	0.006	0.007	0.009	0.009	0.010	0.010	0.010	0.009	0.230
9	0.076	0.041	0.051	0.042	0.042	0.049	0.056	0.062	0.065	0.071	0.056	0.400
10	0.029	0.007	0.006	0.007	0.007	0.008	0.010	0.011	0.011	0.011	0.010	0.184
11	0.051	0.035	0.044	0.058	0.046	0.047	0.052	0.062	0.069	0.075	0.058	0.330
12	0.027	0.006	0.007	0.007	0.009	0.007	0.008	0.010	0.011	0.011	0.009	0.153
13	0.085	0.028	0.038	0.060	0.065	0.055	0.053	0.061	0.068	0.081	0.065	0.210
14	0.033	0.006	0.009	0.008	0.009	0.009	0.007	0.010	0.012	0.014	0.009	0.131
15	0.091	0.022	0.041	0.057	0.078	0.069	0.061	0.063	0.070	0.084	0.078	0.150
16	0.034	0.007	0.010	0.008	0.009	0.009	0.009	0.009	0.012	0.015	0.010	0.115
17	0.079	0.018	0.043	0.053	0.080	0.087	0.077	0.067	0.073	0.082	0.087	0.132
18	0.037	0.007	0.008	0.010	0.009	0.011	0.011	0.010	0.010	0.013	0.014	0.102
19	0.100	0.021	0.032	0.053	0.068	0.091	0.085	0.077	0.072	0.085	0.091	0.118
20	0.031	0.010	0.008	0.011	0.009	0.010	0.010	0.011	0.010	0.012	0.017	0.092
21	0.078	0.023	0.028	0.042	0.051	0.075	0.085	0.086	0.081	0.086	0.085	0.107
22	0.024	0.008	0.009	0.010	0.010	0.010	0.011	0.012	0.011	0.012	0.015	0.084
23	0.072	0.018	0.016	0.036	0.040	0.058	0.080	0.083	0.084	0.089	0.080	0.098
24	0.020	0.006	0.007	0.007	0.009	0.010	0.011	0.011	0.012	0.013	0.011	0.077
25	0.062	0.017	0.017	0.029	0.039	0.042	0.061	0.077	0.080	0.079	0.061	0.090
26	0.016	0.006	0.006	0.007	0.009	0.008	0.009	0.010	0.011	0.012	0.012	0.071
27	0.048	0.018	0.010	0.013	0.025	0.024	0.032	0.052	0.062	0.060	0.047	0.083
28	0.014	0.004	0.005	0.005	0.007	0.007	0.008	0.010	0.010	0.010	0.009	0.066
29	0.048	0.014	0.008	0.013	0.014	0.021	0.015	0.031	0.033	0.034	0.040	0.078
30	0.014	0.004	0.004	0.005	0.005	0.006	0.007	0.008	0.010	0.010	0.008	0.061
31	0.040	0.014	0.006	0.008	0.013	0.016	0.017	0.019	0.026	0.035	0.037	0.073
32	0.012	0.004	0.003	0.004	0.005	0.005	0.006	0.008	0.009	0.009	0.007	0.058
33	0.038	0.014	0.006	0.008	0.011	0.014	0.015	0.017	0.027	0.030	0.036	0.068
34	0.011	0.003	0.003	0.003	0.004	0.005	0.005	0.008	0.008	0.009	0.006	0.054
35	0.034	0.011	0.005	0.006	0.007	0.009	0.011	0.013	0.015	0.019	0.032	0.064
36	0.011	0.003	0.003	0.003	0.003	0.004	0.004	0.006	0.007	0.009	0.004	0.051
37	0.027	0.010	0.004	0.005	0.005	0.007	0.010	0.012	0.016	0.017	0.028	0.061
38	0.010	0.003	0.002	0.002	0.003	0.003	0.004	0.005	0.006	0.008	0.004	0.048
39	0.027	0.011	0.003	0.005	0.005	0.006	0.007	0.009	0.012	0.014	0.025	0.058
40	0.010	0.003	0.002	0.002	0.003	0.003	0.003	0.004	0.005	0.008	0.003	0.046
Remark:The maximum values in the three phases are recorded in the table												

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Harmonics (IEC 61000-3-12)													
Power P/Pn[%]	3	10	20	30	40	50	60	70	80	90	100	IEC 61000-3-12 limit	
Ordinal number	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	1 phase [%]	3 phase [%]
2	0.454	0.190	0.201	0.224	0.236	0.259	0.293	0.339	0.385	0.431	0.293	8%	8%
3	0.564	0.512	0.495	0.460	0.454	0.477	0.466	0.541	0.569	0.610	0.684	21.6%	Not stated
4	0.150	0.046	0.046	0.046	0.052	0.058	0.063	0.075	0.086	0.092	0.063	4%	4%
5	0.500	0.466	0.345	0.357	0.362	0.374	0.385	0.374	0.385	0.420	0.466	10.7%	10.7%
6	0.155	0.035	0.035	0.040	0.040	0.046	0.052	0.052	0.058	0.058	0.052	2.67%	2.67%
7	0.541	0.299	0.247	0.230	0.265	0.293	0.311	0.328	0.328	0.345	0.311	7.2%	7.2%
8	0.150	0.035	0.035	0.035	0.040	0.052	0.052	0.058	0.058	0.058	0.052	2%	2%
9	0.437	0.236	0.293	0.242	0.242	0.282	0.322	0.357	0.374	0.408	0.322	3.8%	Not stated
10	0.167	0.040	0.035	0.040	0.040	0.046	0.058	0.063	0.063	0.063	0.058	1.6%	1.6%
11	0.293	0.201	0.253	0.334	0.265	0.270	0.299	0.357	0.397	0.431	0.334	3.1%	3.1%
12	0.155	0.035	0.040	0.040	0.052	0.040	0.046	0.058	0.063	0.063	0.052	1.33%	1.33%
13	0.489	0.161	0.219	0.345	0.374	0.316	0.305	0.351	0.391	0.466	0.374	2%	2%
14	0.190	0.035	0.052	0.046	0.052	0.052	0.040	0.058	0.069	0.081	0.052	-	-
15	0.523	0.127	0.236	0.328	0.449	0.397	0.351	0.362	0.403	0.483	0.449	-	-
16	0.196	0.040	0.058	0.046	0.052	0.052	0.052	0.052	0.069	0.086	0.058	-	-
17	0.454	0.104	0.247	0.305	0.460	0.500	0.443	0.385	0.420	0.472	0.500	-	-
18	0.213	0.040	0.046	0.058	0.052	0.063	0.063	0.058	0.058	0.075	0.081	-	-
19	0.575	0.121	0.184	0.305	0.391	0.523	0.489	0.443	0.414	0.489	0.523	-	-
20	0.178	0.058	0.046	0.063	0.052	0.058	0.058	0.063	0.058	0.069	0.098	-	-
21	0.449	0.132	0.161	0.242	0.293	0.431	0.489	0.495	0.466	0.495	0.489	-	-
22	0.138	0.046	0.052	0.058	0.058	0.058	0.063	0.069	0.063	0.069	0.086	-	-
23	0.414	0.104	0.092	0.207	0.230	0.334	0.460	0.477	0.483	0.512	0.460	-	-
24	0.115	0.035	0.040	0.040	0.052	0.058	0.063	0.063	0.069	0.075	0.063	-	-
25	0.357	0.098	0.098	0.167	0.224	0.242	0.351	0.443	0.460	0.454	0.351	-	-
26	0.092	0.035	0.035	0.040	0.052	0.046	0.052	0.058	0.063	0.069	0.069	-	-
27	0.276	0.104	0.058	0.075	0.144	0.138	0.184	0.299	0.357	0.345	0.270	-	-
28	0.081	0.023	0.029	0.029	0.040	0.040	0.046	0.058	0.058	0.058	0.052	-	-
29	0.276	0.081	0.046	0.075	0.081	0.121	0.086	0.178	0.190	0.196	0.230	-	-
30	0.081	0.023	0.023	0.029	0.029	0.035	0.040	0.046	0.058	0.058	0.046	-	-
31	0.230	0.081	0.035	0.046	0.075	0.092	0.098	0.109	0.150	0.201	0.213	-	-
32	0.069	0.023	0.017	0.023	0.029	0.029	0.035	0.046	0.052	0.052	0.040	-	-
33	0.219	0.081	0.035	0.046	0.063	0.081	0.086	0.098	0.155	0.173	0.207	-	-
34	0.063	0.017	0.017	0.017	0.023	0.029	0.029	0.046	0.046	0.052	0.035	-	-
35	0.196	0.063	0.029	0.035	0.040	0.052	0.063	0.075	0.086	0.109	0.184	-	-
36	0.063	0.017	0.017	0.017	0.017	0.023	0.023	0.035	0.040	0.052	0.023	-	-
37	0.155	0.058	0.023	0.029	0.029	0.040	0.058	0.069	0.092	0.098	0.161	-	-
38	0.058	0.017	0.012	0.012	0.017	0.017	0.023	0.029	0.035	0.046	0.023	-	-
39	0.155	0.063	0.017	0.029	0.029	0.035	0.040	0.052	0.069	0.081	0.144	-	-
40	0.058	0.017	0.012	0.012	0.017	0.017	0.017	0.023	0.029	0.046	0.017	-	-
THC/Iref	1.774	0.893	0.896	1.034	1.193	1.327	1.400	1.482	1.573	1.689	1.400	23%	13%
PWHD	6.206	4.143	4.520	4.928	5.177	4.511	4.928	5.177	5.497	5.927	5.177	23%	22%
Remark:The maximum values in the three phases are recorded in the table													

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E.6 Certificate of the network and system protection

Certificate of NS protection	No. 704092377001-00		
Manufacturer	Solar.on Sun Technologies GmbH Portastraße 21, 32545 Bad Oeynhausen, GERMANY		
Type of NS protection			
Central NS protection	☐		
Integrated NS protection	☑	Assigned to power generation unit type	5000 W (for model SSG-5TL-ZH) 6000 W (for model SSG-6TL-ZH) 8000 W (for model SSG-8TL-ZH) 10000 W (for model SSG-10TL-ZH) 12000 W (for model SSG-12TL-ZH)
Network connection rules	**VDE-AR-N 4105:2018-11/Corrigendum 1:2020-10** Generators connected to the low-voltage distribution network - Technical requirements for the connection to and parallel operation with low-voltage distribution networks.		
Test requirement	**DIN VDE V 0124-100 (VDE V 0124-100):2020-06 "Network integration of power generation system – Low voltage"** Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network.		
The network and system protection mentioned above meets the requirements of VDE-AR-N 4105.			

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

Extract from test report for NS protection "Determination of electrical properties"		No. 704092377001-00
NS protection test report		
Type of NS system:	Integrated NS protection	**Other Manufacturer indications**
Software version:	DSP: D2301, ARM: 2301	
Manufacturer:	Solar.on Sun Technologies GmbH Portastraße 21, 32545 Bad Oeynhausen, GERMANY	
Measuring period:	From 2023-08-23 to 2023-09-18, 2023-12-13	

	Inverter		
	directly coupled synchronous and asynchronous generators with Pn > 50 kW		
Protection function	**Setting value**	**Tripping value**	**Break time NS protection ***
Rise-in-voltage protection *U* >>	1.25 * U_n	L1-N/L2-N/L3-N: 288 V, 288 V, 288 V, L1-N: 290 V, L2-N: 288 V, L3-N: 289 V,	L1-N/L2-N/L3-N: 115 ms, L1-N: 108 ms, L2-N: 103 ms, L3-N: 102 ms,
Rise-in-voltage protection *U* >	1.10 * U_n	1.0 * U_n	496 ms
Voltage drop protection *U* <	0.8 * U_n	L1-N/L2-N/L3-N: 183 V, 184 V, 184 V, L1-N: 184 V, L2-N: 183 V, L3-N: 184 V,	L1-N/L2-N/L3-N: 3016 ms, L1-N: 3036 ms, L2-N: 3038 ms, L3-N: 3029 ms,
Voltage drop protection *U* <<	0.45 * U_n	L1-N/L2-N/L3-N: 102 V, 102 V, 102 V, L1-N: 102 V, L2-N: 102 V, L3-N: 102 V,	L1-N/L2-N/L3-N: 316 ms, L1-N: 306 ms, L2-N: 319 ms, L3-N: 314 ms,
Frequency decrease protection *f* <	47.5 Hz	47.47 Hz	110 ms
Frequency increase protection *f* >	51.5 Hz	51.48 Hz	104 ms

*: 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. 496 s (L1-N) / 496 s (L2-N) / 497 s (L3-N) (from 600s@U_n to 112%U_n)
2. Continuous operation (L1-N/L2-N/L3-N) (from 600s@U_n to 108%U_n)
3. 301 s (L1-N) / 302 s (L2-N) / 303 s (L3-N) (from 600s@106%U_n to 114%U_n)

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☑ **as integrated NS protection**	
Assigned to power generation unit type	5000 W (for model SSG-5TL-ZH) 6000 W (for model SSG-6TL-ZH) 8000 W (for model SSG-8TL-ZH) 10000 W (for model SSG-10TL-ZH) 12000 W (for model SSG-12TL-ZH)
Integrated interface switch type	Series-connected relays for both the neutral conductor and the line conductor Relay type: HF161F-40W
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.	☑