



**Technical Report No.: 64.290.19.01425.01**

**Date: 2020-04-15**

**Client:** Name: Shanghai Sermatec Energy Technology Co., Ltd.  
Address: Room 601-602, Block A, No.399, ZhongRen Road, JiaDing District, ShangHai, China  
contact person: Wang Wenmei

**Manufacturing place:** Manufacturer's name: Shanghai Sermatec Energy Technology Co., Ltd.  
Address: Room 601-602, Block A, No.399, ZhongRen Road, JiaDing District, ShangHai, China

Factory's name: Mianyang Zenith New Energy Technology Co., LTD  
Address: No. 7 Innovation East Road, Mojia Town, New District, Mianyang High-tech Zone, Sichuan, PEOPLE'S REPUBLIC OF CHINA

**Test subject:** Product: Hybrid Inverter  
Type: SMT-5K-TL-LV  
Trade mark (if any): 

**Test specification:** VDE-AR-N 4105:2018

**Purpose of examination:** Test according to the test specification

**Test result:** The test results show that the presented product is in compliance with the specified requirements.

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## 1 Description of the test subject

### 1.1 Function

- 1) The unit is non-isolated (transformerless) hybrid energy inverter for connection with public low voltage grid, for outdoor use.
- 2) The unit shall be used at specified ambient range. Temperature: -25 °C ~ +60 °C, Auto-derating at 45 °C; Humidity: 4% ~ 100%; Altitude: < 2000 m; Overvoltage category: II (DC side), III (AC side).
- 3) The unit provides two relays in series on each phase between inverter output and grid terminal (L, N). The internal control is redundantly built. It contains a main DSP and a slave DSP. Both DSP can open relays independently and communicate with each other.
- 4) The backup load is floating when inverter works in stand-alone mode. For special requirement of earth system in certain country, this setting shall be changed to comply with local code.
- 5) The battery side is considered as DVC-C circuit, which is with functional insulation from PV and grid side.
- 6) Software version: Small5kw\_V122A00D00.
- 7) In order to protect user and equipment, circuit breaker shall be equipped on all input and output terminal.
- 8) Low voltage electrical installations shall comply with national and local regulation.

### 1.2 Consideration of the foreseeable

- ☐ Not applicable  
☒ Covered through the applied standard  
☐ Covered by the following comment  
☐ Covered by attached risk analysis

### 1.3 Technical Data

Model	SMT-5K-TL-LV
PV terminal	
Vmax. PV	580 Vd.c.
MPPT voltage range	125~550Vd.c.
Max. continuous PV input current	11/11 Ad.c.
Isc PV	14/14 Ad.c.
Max. continuous PV input power	6000W
Battery terminal parameter	
Battery type	Li-ion
Voltage range	40-58 Vd.c.
Rated voltage	48 Vd.c.
Maximum charge/discharge current	70/100 Ad.c.
Maximum charge/discharge power	4200/4600 W
Grid terminal parameter	
Rated voltage	230 Va.c.
Rated frequency	50 Hz
Rated input current	20 Aa.c.
Maximum continuous input current	20.9 Aa.c.
Maximum continuous input power	4600 W
Rated output current	20 Aa.c.
Maximum continuous output current	20.9 Aa.c.
Power factor (Cos phi), adjustable	0.8leading~0.8lagging

Maximum continuous output power	4600 W
Backup load terminal parameter	
Rated voltage	230 Va.c.
Rated frequency	50 Hz
Rated output current	21.7 Aa.c.
Maximum continuous output current	22.8 Aa.c.
Maximum continuous output power	4600W

## 2 Order

### 2.1 Date of Purchase Order, Customer's Reference

2018-07-18

### 2.2 Receipt of Test Sample, Condition, Location

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch  
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China

### 2.3 Date of Testing

2020-03-01 to 2020-04-10

### 2.4 Location of Testing

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch  
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China

### 2.5 Points of Non-compliance or Exceptions of the Test Procedure

None

## 3 Test Results

☒ Decision rule according to IEC Guide 115:2007, clause 4.4.3, 4.5.1 (accuracy method) was applied.

### 3.1 Positive Test Results

- Functional safety (VDE-AR-N 4105:2018)



#### 4 Remark

- 4.1 The user manual has been examined according to the minimum requirements described in the product standard. The manufacturer is responsible for the accuracy of further particulars as well as of the composition and layout.
- 4.2 When the product is placed on the market, it must be accompanied with safety Instructions written in official language of the country. The instructions shall give information regarding safe operation, installation and maintenance.
- 4.3 When measurement results are close to limit value of specified requirement, manufacturer shall take actions during the production process to keep the limit, especially if the result of a measurement is in a bandwidth within  $\pm 10\%$  to the limit value.
- 4.4 According to the EU directives which have been aligned with EU NLF (new legislative framework), both of manufacturer and importer's name and address shall be affixed on the product or, where that is not possible, on its packaging or in a document accompanying the product before the product is placed on the EU market.
- 4.5 The manufacturer/ Importer has to ensure the appliance placing on the EU market conforms to the applicable EU directives which provide the affixing of the CE marking, such as LVD, EMC, RoHS, ErP, and so on.

#### 5 Documentation

- N/A

#### 6 Summary

The test specifications are met.

**TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch**  
**TÜV SÜD Group**

Tested by:

Iris Zheng

*printed name, function & signature*

Approved by:

Max Fang

*printed name, function & signature*



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

Extract of the test report for power generation units “Determination of electrical properties”				No.: YYYY – nnnn (Engineering Sample)		
System manufacturer:		Shanghai Sermatec Energy Technology Co., Ltd.				
Manufacturer indications:		System type (BHKW, PV-WR, ...)		Hybrid Inverter		
		Max. active power $P_{E_{max}}$		4587 W (Model: SMT-5K-TL-LV)		
		Max. apparent power $S_{E_{max}}$		4589 VA (Model: SMT-5K-TL-LV)		
		Rated voltage		230Va.c.		
Measurement period		2020-03-01 to 2020-04-10		-----		
Connection without provisions (regarding the primary energy carrier)				$k_i = \underline{0.08}$		
Most adverse case when switching between generator levels				$k_i = \underline{0.41}$		
Connection at nominal conditions (of the primary energy carrier)				$k_i = \underline{0.16}$		
Disconnection at rated power				$k_i = \underline{0.69}$		
Worst value of all switching operations				$k_{imax} = \underline{0.69}$		
Flicker	Network impedance angle $\Psi_k$	32° <sup>a)</sup>	30°	50°	70°	85°
	Initial flicker factor $c_\psi$	3.25	--	--	--	--
Remark:						
<sup>a)</sup> According to VDE V 0124-100, the worst case is measured at 32° network impedance angle and the other angles are waived.						

**TABLE: Harmonics**

Harmonics of PGU comply with DIN EN 61000-3-2 and DIN EN 61000-3-12, if not, harmonics and inter-harmonics are measured according to this guideline, class A											
Harmon. Nr.	P/P <sub>E<sub>max</sub></sub>										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2	0.010	0.019	0.025	0.017	0.002	0.026	0.029	0.021	0.000	0.024	0.010
3	0.249	0.275	0.250	0.251	0.255	0.286	0.306	0.337	0.366	0.411	0.461
4	0.019	0.027	0.029	0.027	0.012	0.018	0.027	0.031	0.025	0.012	0.031
5	0.114	0.100	0.122	0.199	0.213	0.207	0.191	0.170	0.150	0.132	0.118
6	0.001	0.016	0.006	0.016	0.013	0.010	0.013	0.013	0.018	0.016	0.017
7	0.055	0.048	0.033	0.065	0.099	0.132	0.152	0.165	0.174	0.174	0.169
8	0.006	0.014	0.007	0.015	0.014	0.008	0.013	0.021	0.015	0.020	0.017
9	0.038	0.051	0.027	0.027	0.057	0.081	0.085	0.091	0.102	0.108	0.121
10	0.009	0.015	0.007	0.023	0.014	0.020	0.014	0.021	0.015	0.019	0.012
11	0.020	0.019	0.036	0.027	0.041	0.037	0.045	0.065	0.076	0.082	0.078
12	0.010	0.008	0.007	0.006	0.007	0.006	0.012	0.013	0.004	0.006	0.004
13	0.010	0.004	0.026	0.010	0.024	0.048	0.053	0.049	0.049	0.059	0.067
14	0.006	0.007	0.004	0.004	0.014	0.013	0.016	0.012	0.018	0.021	0.012
15	0.007	0.009	0.014	0.011	0.011	0.025	0.035	0.047	0.053	0.045	0.046
16	0.008	0.016	0.006	0.007	0.012	0.010	0.008	0.008	0.011	0.019	0.012

17	0.008	0.012	0.015	0.004	0.007	0.027	0.032	0.039	0.047	0.050	0.053
18	0.003	0.007	0.005	0.013	0.013	0.002	0.002	0.008	0.006	0.004	0.002
19	0.005	0.003	0.005	0.017	0.004	0.008	0.022	0.033	0.028	0.033	0.047
20	0.005	0.002	0.004	0.001	0.007	0.007	0.002	0.007	0.006	0.008	0.007
21	0.004	0.004	0.006	0.010	0.011	0.011	0.011	0.017	0.035	0.035	0.038
22	0.004	0.003	0.005	0.012	0.011	0.015	0.007	0.010	0.016	0.012	0.010
23	0.004	0.005	0.005	0.014	0.006	0.005	0.013	0.020	0.022	0.027	0.033
24	0.003	0.001	0.004	0.003	0.003	0.003	0.010	0.007	0.007	0.005	0.009
25	0.003	0.001	0.006	0.009	0.008	0.005	0.006	0.014	0.017	0.019	0.027
26	0.003	0.003	0.002	0.004	0.002	0.003	0.004	0.006	0.006	0.008	0.007
27	0.003	0.005	0.005	0.004	0.006	0.005	0.005	0.006	0.012	0.016	0.021
28	0.001	0.003	0.002	0.005	0.004	0.003	0.006	0.003	0.005	0.004	0.005
29	0.003	0.001	0.002	0.004	0.004	0.004	0.002	0.007	0.007	0.012	0.024
30	0.001	0.002	0.004	0.003	0.004	0.005	0.002	0.003	0.005	0.004	0.006
31	0.003	0.003	0.004	0.004	0.004	0.003	0.003	0.004	0.009	0.008	0.018
32	0.001	0.001	0.002	0.002	0.002	0.001	0.004	0.007	0.005	0.009	0.007
33	0.004	0.004	0.001	0.003	0.003	0.006	0.011	0.006	0.007	0.009	0.010
34	0.001	0.001	0.003	0.002	0.003	0.003	0.003	0.008	0.006	0.002	0.008
35	0.006	0.002	0.004	0.002	0.001	0.006	0.004	0.003	0.005	0.007	0.018
36	0.001	0.002	0.001	0.002	0.003	0.004	0.002	0.003	0.001	0.005	0.006
37	0.005	0.003	0.001	0.001	0.004	0.004	0.008	0.005	0.002	0.004	0.012
38	0.001	0.002	0.000	0.002	0.003	0.003	0.001	0.007	0.006	0.003	0.008
39	0.005	0.004	0.003	0.003	0.004	0.003	0.007	0.004	0.003	0.008	0.006
40	0.001	0.002	0.003	0.004	0.002	0.001	0.003	0.001	0.008	0.005	0.015

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

<b>Extract of the test report for NS protection</b> "Determination of electrical properties"		No.: YYYY – nnnn (Engineering Sample)	
<b>Test report NS protection</b>			
Type of NS protection:	Integrated NS protection – Interface switch	Further manufacturer indications	
Software version:	Small5kw_V122A00D00	--	
Manufacturer:	Shanghai Sermatec Energy Technology Co., Ltd.		
Measurement period:	2020-03-01 to 2020-04-10		
		<b>Inverter(s)</b>	
Protective function	Set value	Tripping value	Tripping time NS protection*
Rise-in-voltage protection $U >>$	$1.25 * U_n$	285.2 V	28 ms
Rise-in-voltage protection $U >$	$1.10 * U_n$	$1.00U_n - 1.12U_n$ 230V – 257.6V	480 s
		$1.00U_n - 1.08U_n$ 230V – 248.4V	No Disconnection
		$1.06U_n - 1.14U_n$ 243.8V – 262.2V	277 s
Voltage drop protection $U <$	$0.8 * U_n$	182.8 V	3050 ms
Voltage drop protection $U <$	$0.45 * U_n$	104.5 V	322 ms
Frequency decrease protection $f <$	47.5 Hz	47.54 Hz	83 ms
Frequency increase protection $f >$	51.5 Hz	51.53 Hz	70 ms
* The above tripping time includes the entire function chain "integrated NS protection – interface switch"			
<input checked="" type="checkbox"/> <b>For integrated NS protection</b>			
Assigned to power generation unit of type		Type 2	
Type integrated interface switch		Relay	
Response time of interface switch for integrated NS protection		Manufacture: Xiamen Hongfa Electric Prower Controls Co., Ltd. Model: HF161F-W/12-HT Rated current: 31A Response time: 20ms	
Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.		Yes	

--- End of Report ---