


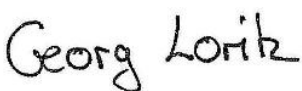


**BUREAU
VERITAS**

TEST REPORT EN 50438

Requirements for the connection of micro-generators
in parallel with public low-voltage distribution networks

Report reference number	12TH0259-EN50438_3						
Date of issue	2014-07-15						
Total number of pages	13						
Testing laboratory name	Bureau Veritas Consumer Products Services Germany GmbH			 Deutsche Akkreditierungsstelle D-PL-12024-03-01			
Address	Businesspark A96 86842 Türkheim Germany						
Applicant's name	SMA Solar Technology AG						
Address	Sonnenallee 1, 34266 Niestetal						
Test specification							
Standard.....	EN 50438:2007 DIN V VDE V 0126-1-1:2006-02						
Certificate	Certificate of compliance						
Test report form number	EN50438						
Master TRF	Bureau Veritas Consumer Products Services Germany GmbH						
Test item description	Grid-tied photovoltaic and wind inverter						
Trademark.....							
Model / Type	STP 5000TL-20, STP 6000TL-20, STP 7000TL-20, STP 8000TL-20, STP 9000TL-20, STP 10000TL-20, STP 12000TL-20						
Ratings	STP 5000 TL-20	STP 6000 TL-20	STP 7000 TL-20	STP 8000 TL-20	STP 9000 TL-20	STP 10000 TL-20	STP 12000 TL-20
MPP DC voltage range [V].....	245-800	295-800	290-800	330-800	370-800	370-800	440-800
Input DC voltage range [V].....	max. 1000						
Input DC current [A]	11/10	11/10	15/10	15/10	15/10	18/10	18/10
Output AC voltage [V]	3x 230/400						
Output AC current [A].....	7,3	8,7	10,2	11,6	13,1	14,5	17,4
Output power [VA].....	5000	6000	7000	8000	9000	10000	12000

Testing Location	Bureau Veritas Consumer Products Services Germany GmbH		
Address	Businesspark A96, 86842 Türkheim, Germany		
Tested by (name and signature)	Frederic Schmitt		
Approved by (name and signature)	Georg Loritz		
Manufacturer's name	SMA Solar Technology AG		
Factory address	Sonnenallee 1 34266 Niestetal Germany		

Document History			
Date	Internal reference	Modification / Change / Status	Revision
2012-09-27	Ingo Röhr	Initial report was written	0
2012-10-29	Ingo Röhr	Windy Tripower inverter WTP 5000TL-20, WTP 6000TL-20, WTP 7000TL-20, WTP 8000TL-20 included	1
2014-04-09	Ingo Röhr	Model STP10000TL-20 was added	2
2014-06-11	Frederic Schmitt	Additional model STP 12000TL-20 was added. Corresponding tests were performed.	3

Test items particulars	
Equipment mobility.....	Permanent connection
Operating condition.....	Continuous
Class of equipment	Class I
Protection against ingress of water..	IP65 according to EN 60529
Mass of equipment [kg].....	STP 5000TL-20 37kg
	STP 6000TL-20 37kg
	STP 7000TL-20 37kg
	STP 8000TL-20 37kg
	STP 9000TL-20 37kg
	STP 1000TL-20 37kg
	STP 12000TL-20 37kg
Test case verdicts	
Test case does not apply to the test object.....	N/A
Test item does meet the requirement.....	P(ass)
Test item does not meet the requirement.....	F(ail)
Testing	
Date of receipt of test item	2012-05-25, 2014-06-11
	2012-05-31 until 2012-06-01
Date(s) of performance of test	2014-03-15 until 2014-03-29
	2014-06-11 unit 2014-06-17
<p>General remarks:</p> <p>The test result presented in this report relate only to the object(s) tested. This report must not be reproduced in part or in full without the written approval of the issuing testing laboratory</p> <p>"(see Annex #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a comma is used as the decimal separator.</p>	
This Test Report consists of the following documents:	
<ol style="list-style-type: none"> 1. Test Results 2. Annex No. 1 – EMC Test Report 3. Annex No. 2 – Pictures of the units 4. Annex No. 3 – Test equipment list 	

Copy of marking plate:

<p>SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Germany www.SMA.de</p> <p>SUNNY TRIPOWER Solar inverter made in Germany by SMA Solar Technology AG</p> <p>Model STP 5000TL-20</p> <p>Serial No. DUMMY</p> <p>Date of manufacture 2012-08-14</p> <table border="1"> <tr><td>DC</td><td>V_{DC max}</td><td>1000 V</td></tr> <tr><td></td><td>V_{DC MPP}</td><td>245 - 800 V</td></tr> <tr><td></td><td>I_{DC max}</td><td>11 A/10 A</td></tr> <tr><td rowspan="5">AC 3N</td><td>V_{AC,r}</td><td>380/400/415 V</td></tr> <tr><td>P_{AC,r}</td><td>5000 W</td></tr> <tr><td>S_{max}</td><td>5000 VA</td></tr> <tr><td>f_{AC,r}</td><td>50/60 Hz</td></tr> <tr><td>I_{AC max}</td><td>7.3 A</td></tr> <tr><td colspan="2">COS(φ)</td><td>0.8 <small>enriched</small> 0.8 <small>unbalanced</small></td></tr> </table> <p>IP65 max. 37 kg Safety class I Overvoltage protection III</p> <p>Do not connect!</p> <p>STP 5000TL-20 / 08/2012 DUMMY</p>	DC	V _{DC max}	1000 V		V _{DC MPP}	245 - 800 V		I _{DC max}	11 A/10 A	AC 3N	V _{AC,r}	380/400/415 V	P _{AC,r}	5000 W	S _{max}	5000 VA	f _{AC,r}	50/60 Hz	I _{AC max}	7.3 A	COS(φ)		0.8 <small>enriched</small> 0.8 <small>unbalanced</small>	<p>SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Germany www.SMA.de</p> <p>SUNNY TRIPOWER Solar inverter made in Germany by SMA Solar Technology AG</p> <p>Model STP 6000TL-20</p> <p>Serial No. DUMMY</p> <p>Date of manufacture 2012-08-14</p> <table border="1"> <tr><td>DC</td><td>V_{DC max}</td><td>1000 V</td></tr> <tr><td></td><td>V_{DC MPP}</td><td>295 - 800 V</td></tr> <tr><td></td><td>I_{DC max}</td><td>11 A/10 A</td></tr> <tr><td rowspan="5">AC 3N</td><td>V_{AC,r}</td><td>380/400/415 V</td></tr> <tr><td>P_{AC,r}</td><td>6000 W</td></tr> <tr><td>S_{max}</td><td>6000 VA</td></tr> <tr><td>f_{AC,r}</td><td>50/60 Hz</td></tr> <tr><td>I_{AC max}</td><td>8.7 A</td></tr> <tr><td colspan="2">COS(φ)</td><td>0.8 <small>enriched</small> 0.8 <small>unbalanced</small></td></tr> </table> <p>IP65 max. 37 kg Safety class I Overvoltage protection III</p> <p>Do not connect!</p> <p>STP 6000TL-20 / 08/2012 DUMMY</p>	DC	V _{DC max}	1000 V		V _{DC MPP}	295 - 800 V		I _{DC max}	11 A/10 A	AC 3N	V _{AC,r}	380/400/415 V	P _{AC,r}	6000 W	S _{max}	6000 VA	f _{AC,r}	50/60 Hz	I _{AC max}	8.7 A	COS(φ)		0.8 <small>enriched</small> 0.8 <small>unbalanced</small>
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	f _{AC,r}	50/60 Hz																																													
	I _{AC max}	10.2 A																																													
COS(φ)		0.8 <small>enriched</small> 0.8 <small>unbalanced</small>																																													
DC	V _{DC max}	1000 V																																													
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SMA Solar Technology AG
Sonnentallee 1
34266 Niestetal
Germany
www.SMA.de

SUNNY TRIPOWER
Solar inverter - made in Germany
by SMA Solar Technology AG

Model
STP 9000TL-20

Serial No.
DUMMY

Date of manufacture
2012-08-14

DC	V _{DC max}	1000 V
	V _{DC MPP}	370 - 800 V
	I _{DC max}	15 A/10 A
AC	V _{AC,r}	380/400/415 V
	P _{AC,r}	9000 W
	S _{max}	9000 VA
	f _{AC,r}	50/60 Hz
	I _{AC max}	13.1 A
	cos(φ)	0.8 <small>oversampled</small> ... 0.8 <small>undersampled</small>

IP65  max. 27 kg

Protective class I Overvoltage category III

Do not connect!

CE 

Sunnydets.com Sunnydets.com

* D U M M Y *

* D U M M Y *

* D U M M Y *

* D U M M Y *

STP 9000TL-20 / 08/2012
DUMMY

SMA Solar Technology AG
Sonnentallee 1
34266 Niestetal
Germany
www.SMA.de


SUNNY TRIPOWER
Solar inverter - made in Germany
by SMA Solar Technology AG

Model
STP 10000TL-20


Serial No.
0000000000

Date of manufacture
2014-02-24

DC	V _{DC max}	1000 V
	V _{DC MPP}	370 - 800 V
	I _{DC max}	18 A/10 A
AC	V _{AC,r}	380/400/415 V
	P _{AC,r}	10000 W
	S _{max}	10000 VA
	f _{AC,r}	50/60 Hz
	I _{AC max}	14.5 A
	cos(φ)	0.8...1...0.8 <small>oversampled/undersampled</small>

IP65  max. 27 kg

Protective class I Overvoltage category III

CE 

N23114

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Germany
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
SUNNY TRIPOWER
Solar inverter - made in Germany
by SMA Solar Technology AG

Model
STP 12000TL-20


Serial No.
0000000000

Date of manufacture
2014-02-24

DC	V _{DC max}	1000 V
	V _{DC MPP}	440 - 800 V
	I _{DC max}	18 A/10 A
AC	V _{AC,r}	380/400/415 V
	P _{AC,r}	12000 W
	S _{max}	12000 VA
	f _{AC,r}	50/60 Hz
	I _{AC max}	17.4 A
	cos(φ)	0.8...1...0.8 <small>oversampled/undersampled</small>

IP65  max. 39 kg

Protective class I Overvoltage category III

CE 

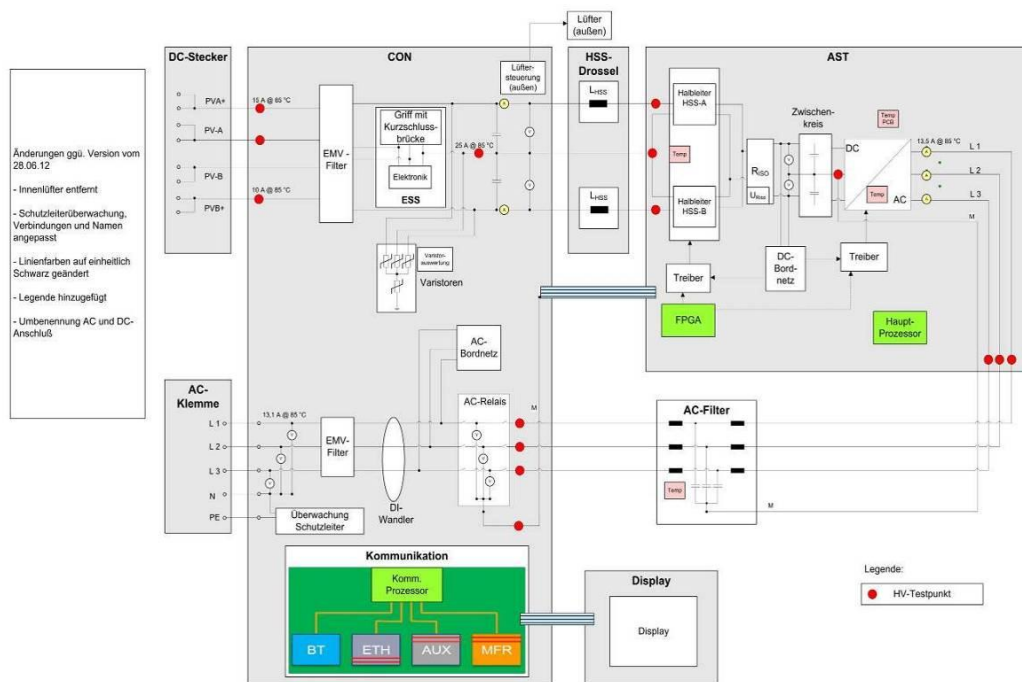
N23114

General product information:

The Solar converter converts DC voltage into AC voltage.

The input and output are protected by Varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output. The output is switched off redundant by the high power switching bridge and two relays in series. This assures that the opening of the output circuit will also operate in case of one error.

The input of the inverter is EMC filtered, the input dc voltage is PWM modulated by the inverter bridge. These PWM blocks are filtered by the following inductors and capacitors and finally result in the 50Hz sine wave. The automatic disconnection facility is integral part of the inverter, permanently monitoring the grid frequency and voltage. In Addition the unit provides active anti islanding detection via frequency shifting.



The inverter models STP 5000TL-20, STP 6000TL-20, STP 7000TL-20 and the STP 8000TL-20 are software derated versions of STP 9000TL-20 since their hardware is identical.

Description of the differences between STP 10000TL-20 and STP x000TL-20:

The inverter model STP 10000TL-20 is identical in hardware to the STP x000TL-20 series, except for the current sensor and the choke. All relevant tests were performed at the STP 10000TL-20. A note is placed in the table of the measurement.

Description of the differences between STP 12000TL-20 and STP xx000TL-20:

The STP 12000TL-20 is identical to the STP xx000TL-20 series, except for the semi-conductor. All relevant tests were performed at the STP 12000TL-20. A note is placed in the table of the measurement.

The product was tested on:

Software version: Firmware Pack 2.52

Hardware version:

PCBs:

STP x000TL-20	STP 10000TL-20	STP 12000TL-20
STP90-AST: U1 STP90-CON: T2 STP90-ESS: R1	STP100-CON: P5 STP100-AST: P4	STP120-CON: P1 STP120-AST: P2

Default interface protection settings according EN 50438:2007:		
Parameter	Max. clearance time	Trip setting
Over voltage	0,2s	230V +15% (264,5V)
Under voltage	1,5s	230V -15% (195,5V)
Over frequency	0,5s	50Hz +2% (51,0Hz)
Under frequency	0,5s	50Hz -6% (47,0Hz)
Reconnection time	>=20s	
<p>The stated currents and voltages are 'true r.m.s.'-values. The voltages in this table are - phase-to-neutral in 230 V single phase systems and 230/400 V systems, - phase-to-phase in a multiphase 230 V system.</p>		
<p>*Over voltage – stage1: 10min mean value corresponding to EN 50160 Tolerances on trip values: - Voltage: +/- 1% of the nominal voltage; - Frequency: +/- 0,5% of the nominal frequency - Clearance time: +/- 10%</p>		

EN 50438:2007			
Clause/§	Requirement:	Remark:	Verdict

1	Scope (Micro-generators up to 16A on the public low-voltage grid)		
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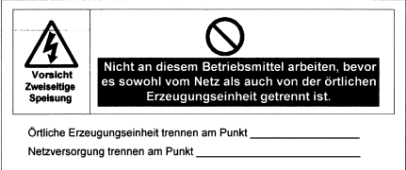
2	Normative references		
	EN 50110 series		
	EN 50160		
	EN 60255-6		
	EN 60664-1		
	EN 61000-3-2		
	EN 61000-3-3		
	EN 61000-6-1		
	EN 61000-6-3:2001 + A11:2004		
	HD 384 / HD 60364 series		
	IEC 60364-5-55		

3	Terms and definitions		
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4	Connection requirements:		
4.1	The electrical installation.....:	The installation shall be in compliance with HD 384 series and national and local regulation.	P
4.1.1	Installation instructions.....:	Maintenance in accordance with the instructions issued by the manufacturer	P
4.1.2	Over-current protection.....:	The manufacturer recommends an over-current protection device in the manual	P
4.1.3	Earthing.....:	Earthing shall be according to HD 384.5.54 / IEC 60364-5-55 and the relevant national standards.	P
4.2	Interface protection		P
4.2.1	General.....:	The interface protection, monitoring and control functions are integral part of the inverter.	P
4.2.1.1	Default settings versus national settings.....:	Default settings of table 2 are applied	P

EN 50438:2007			
Clause/§	Requirement:	Remark:	Verdict
4.2.1.2	Response to protection operation.....:	Response to protection operation was tested by "BGFE Berufsgenossenschaft der Feinmechanik und Elektrotechnik" Report No.: UB.010.17/6-122 Address: Berufsgenossenschaft der Feinmechanik und Elektrotechnik Gustav-Heinemann-Ufer 130 50968 Köln The requirements of functional safety are to be met. The VDE0126-1-1 test report is stored on Server Bureau Veritas Consumer Products Services Germany Server. Project: 12TH0259.	P
4.2.1.3	Accessibility of isolation switching devices.....:	The transformerless unit provides two disconnection devices in series.	P
4.2.1.4	Place of the interface protection.....:	The interface protection is integral part of the inverter and conform to EN 60255-6 or equivalent. The manufacturer declares conformity of his product to this standard within the CE declaration of conformity.	P
4.2.1.5	Changing settings of the interface protection.....:	It is not possible for the user to alter the interface protection settings	P
4.2.1.6	Combined protection devices for multiple generators.....:	The proper combined working of the protection is ensured	P
4.2.2	Interface protection settings.....:	Default interface protection settings are applied, see table 4.2.2 below	P

EN 50438:2007			
Clause/§	Requirement:	Remark:	Verdict
4.2.3	Loss of Mains protection.....:	<p>Response to protection operation was tested by</p> <p>“BGFE Berufsgenossenschaft der Feinmechanik und Elektrotechnik“</p> <p>Report No.: UB.010.17/6-122</p> <p>Address:</p> <p>Berufsgenossenschaft der Feinmechanik und Elektrotechnik Gustav-Heinemann-Ufer 130 50968 Köln</p> <p>3.7 Recognition of an isolated operation.</p> <p>A recognition of the island formation is the process of "escalating frequency drift" (report V3) or impedance measurement (report V2).</p> <p>Here is an algorithm in the control ensured that a frequency drift is increased (up or down) in the current direction. This leads to an activation of the monitoring frequency. In addition, the phase angle of voltages to + - 30 ° monitored. The tests performed are documented in (1) Section 3.6 and Annex 2.</p> <p>The trip time was under 500ms in all test cases. The limit of 5 seconds is observed.</p> <p>The VDE0126-1-1 test report is stored on Server Bureau Veritas Consumer Products Services Germany Server. Project: 12TH0259.</p>	P
4.2.4	Automatic reconnection after a network outage....:	>20s, see table 4.2.2 below	P
4.2.5	Synchronisation.....:	Automatic synchronisation of the inverter	P
5	Power quality:		
5.1	Electromagnetic emission / immunity.....:	The inverter complies with the requirements of the EMC directive, see attached EMC report in Annex 1	P
	EN 61000-6-1 (immunity)		P
	EN 61000-6-3 + A11 (emission)		P
	EN 61000-3-2 (harmonics)	See Table 5.1	P
	EN 61000-3-3 (voltage fluctuations and flicker)	See Table 5.1	P

EN 50438:2007			
Clause/§	Requirement:	Remark:	Verdict
5.2	DC injection.....:	<p>Response to protection operation was tested by “BGFE Berufsgenossenschaft der Feinmechanik und Elektrotechnik“Report No.: UB.010.17/6-122 Address: Berufsgenossenschaft der Feinmechanik und Elektrotechnik Gustav-Heinemann-Ufer 130 50968 Köln 3.5 DC monitoring The disconnection takes place through both channels with a DC current from exceeding <1A within 200 ms. The estimated measurement uncertainty of the DC component was 100mA. The VDE0126-1-1 test report is stored on Server Bureau Veritas Consumer Products Services Germany Server. Project: 12TH0259.</p> <p>The permanent DC-injection see below table 5.2.</p>	P
5.3	Power factor.....:	See table 5.3 below	P
6	Operation and safety of the micro-generator		
6.1	General.....:	The unit operates safely over the declared operating range	P
6.2	Safety.....:	This standard does not cover safety of DNO personnel.	P
6.3	Information plate.....:	At least information of manufacturers name, identification, rated power, nom. voltage, nom. frequency, phases and power factor, see above marking plate.	P
6.4	Labelling.....:	<p>The unit provides the following warning label:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">  </div>	P
6.5	Maintainance and routine testing.....:	The manufacturer provides information for maintenance in the manual. The units are routine tested in the factory.	P

EN 50438:2007			
Clause/§	Requirement:	Remark:	Verdict
7	Commissioning		
7.1	General		P
	The micro-generator (including the interface protection) shall fulfil the requirements of this standard and the other applicable standards.....:	Noticed	-
	The manufacturer shall provide an installation instruction in accordance with this standard and national or regional requirements.....:	Verified, see manual.	-
	Access to the interface protection shall be tamper-proof.....:	Access just via password, provided by the manufacturer	-
	The micro-generator shall be type tested against the interface requirements of this standard.....:	Noticed, see test tables below	-
	The installation shall be carried out by installer with recognised and approved qualification	Not scope of investigation	-
7.2	Installation	Not scope of investigation	N/A
7.3	Notification		N/A
7.4	Decommissioning arrangements		N/A
7.5	Replacement arrangements		N/A
Annex			
A (normative)	Interface protection settings, national deviations	No specific national settings are supplied, the default settings in 4.2.2, table 2 are applicable	N/A
B (informative)	Notification sheets		N/A
C (informative)	Interface protection	Noticed	P
D (informative)	Type certification test results sheet	Noticed	P
E (informative)	Countries allowing extensions of the scope >16A		N/A
F (informative)	Abbreviations	Noticed	P
G (informative)	A-deviations		N/A

EN 50438:2007		
Clause	Test	Result
4.2.1.2	Response to protection operation	P
4.2.2	Interface protection settings	P
4.2.3	Loss of Mains protection	P
4.2.4	Automatic reconnection after a network outage	P
5.1	Harmonic current emission	P
5.1	Voltage fluctuation and flicker	P
5.2	DC injection	P
5.3	Power factor	P