




<p>TEST REPORT</p> <p>C10/11:2012</p> <p>Specific technical requirements for decentralized Production plants in parallel working with the Distribution network</p>	
Report reference No.....	140327083GZU-015
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Date of issue	30 May 2014
	18 pages
Testing Laboratory Name	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Address	Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
Testing location	Same as above
Address	Same as above
Applicant's Name	Shenzhen SOFARSOLAR Co., Ltd.
Address	3A-1, Huake Building, East Technology Park, Qiaoxiang Road, Nanshan District, Shenzhen, China
Test specification	
Standard	C10/11:2012
Test procedure	Type test
Non-standard test method	N/A
Test Report Form No..... C10/11a	
TRF originator	Intertek
Master TRF	dated 2014-06
Test item description Grid-connected PV inverter	
Trademark	
Manufacturer	Same as Applicant
Factory.....	Dongguan dingqiang Machinery & Electric Co., Ltd. No. 8, Fulong road, Qingxi town, Dongguan city, Guangdong, China
Model and/or type reference	Sofar 20000TL-Sx, Sofar 17000TL-Sx, Sofar 15000TL-Sx, Sofar 10000TL-Sx (x=0-6)

Rating(s)..... : Maximum d.c. input voltage: 1000 V
Input voltage rang: 250-960 V
Max. input current: 2x24 A (for Sofar 20000TL-Sx); 2x21 A (for Sofar 17000TL-Sx, Sofar 15000TL-Sx); 2x15 A (for Sofar 10000TL-Sx)
Max. PV Isc: 2x30 A (for Sofar 20000TL-Sx); 2x27 A (for Sofar 17000TL-Sx, Sofar 15000TL-Sx); 2x20 A (for Sofar 10000TL-Sx)
Nominal output voltage: 3/N/PE230V/400V
Max. output current: 3x29 A (for Sofar 20000TL-Sx); 3x25 A (for Sofar 17000TL-Sx); 3x22 A (for Sofar 15000TL-Sx); 3x15 A (for Sofar 10000TL-Sx)
Nominal frequency: 50 Hz
Max. output power: 20000 W (for Sofar 20000TL-Sx); 17000 W (for Sofar 17000TL-Sx); 15000 W (for Sofar 15000TL-Sx); 10000 W (for Sofar 10000TL-Sx)
Ingress protection: IP65
Operating temperature range: -25~60°C

Summary of testing:

The sample(s) tested complied with the default type test requirement of C10/11:2012

Copy of marking plate

Solar Inverter	Sofar 10000TL-S3
Max. DC Input Voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input Current	2*15A
Max. PV Isc	2*20A
Nominal Grid Voltage	3/N/PE,230/400V
Max. Output Current	3*15A
Nominal Grid Frequency	50Hz
Max. Output Power	10000W
Power factor	>0.99(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25~+60°C
Protective Class	Class I
Manufacturer: shenzhen SOFARSOLAR Co.,Ltd	
Made in China	
<small>VDE-AR-N4105, RD1699, VDE0126-1-1, G83/2, UTE C15-712-1, C10/11, EN50438</small>	

Solar Inverter	Sofar 15000TL-S3
Max. DC Input Voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input Current	2*21A
Max. PV Isc	2*27A
Nominal Grid Voltage	3/N/PE,230/400V
Max. Output Current	3*22A
Nominal Grid Frequency	50Hz
Max. Output Power	15000W
Power factor	>0.99(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25~+60°C
Protective Class	Class I
Manufacturer: shenzhen SOFARSOLAR Co.,Ltd	
Made in China	
<small>VDE-AR-N4105, RD1699, VDE0126-1-1, G59/3, UTE C15-712-1, C10/11, IEC62116, IEC61727</small>	

Solar Inverter	Sofar 17000TL-S3
Max. DC Input Voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input Current	2*21A
Max. PV Isc	2*27A
Nominal Grid Voltage	3/N/PE,230/400V
Max. Output Current	3*25A
Nominal Grid Frequency	50Hz
Max. Output Power	17000W
Power factor	>0.99(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25~+60°C
Protective Class	Class I
Manufacturer: shenzhen SOFARSOLAR Co.,Ltd	
Made in China	
<small>VDE-AR-N4105, RD1699, VDE0126-1-1, G59/3, UTE C15-712-1, C10/11, IEC62116, IEC61727</small>	

Solar Inverter	Sofar 20000TL-S3
Max. DC Input Voltage	1000V
Operating MPPT voltage range	250-960V
Max. Input Current	2*24A
Max. PV Isc	2*30A
Nominal Grid Voltage	3/N/PE,230/400V
Max. Output Current	3*29A
Nominal Grid Frequency	50Hz
Max. Output Power	20000W
Power factor	>0.99(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25~+60°C
Protective Class	Class I
Manufacturer: shenzhen SOFARSOLAR Co.,Ltd	
Made in China	
<small>VDE-AR-N4105, RD1699, VDE0126-1-1, G59/3, UTE C15-712-1, C10/11, IEC62116, IEC61727</small>	



Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the front surface of enclosure and visible after installation.

<p>Test case verdicts</p> <p>Test case does not apply to the test object :: N/A</p> <p>Test item does meet the requirement: P(ass)</p> <p>Test item does not meet the requirement ...: F(ail)</p>	
<p>Testing</p> <p>Date of receipt of test item: 3 Sep 2010</p> <p>Date(s) of performance of test: 3 Sep 2010 to 13 Sep 2010</p>	
<p>General remarks</p> <p>The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(See Enclosure #)" 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 point is used as the decimal separator.</p> <p>When determining the test conclusion, the Measurement Uncertainty of test has been considered.</p> <p>This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.</p> <p>This report would be valid when used together with report No. 140327081GZU-002, dated 22 May 2014</p>	
<p>General product information:</p> <ol style="list-style-type: none"> 1. Product covered by this report is non-isolated grid-connected PV inverter for connection with low voltage grid in terms of C10/11:2012. 2. The inverters intended to operate at ambient temperature -25°C - +60°C and 250-960 Vdc input, which will be specified in the user manual, The inverters will output full power when operated at 45°C. If operated at higher than 45°C temperature, the output power derating. 3. The firmware version used for testing is V1.00 <p>For all models, if the DC input voltage is higher than 850 Vdc the output power will be derating. For model Sofar 20000TL-Sx, if the DC input voltage is lower than 430 Vdc, the output power will be derating. For model Sofar 17000TL-Sx, if the DC input voltage is lower than 420 Vdc, the output power will be derating. For model Sofar 15000TL-Sx, if the DC input voltage is lower than 370 Vdc, the output power will be derating. For model Sofar 10000TL-Sx, if the DC input voltage is lower than 350 Vdc, the output power will be derating.</p> <p>For all models, if the AC output voltage is lower than 230 Vac the output current will be limited to not higher than rated output current.</p> <p>Model difference: All the models have identical mechanical and electrical construction except some components and some parameter of the software architecture in order to control the max output power. And refer to the following table for detail.</p>	

Model	DC Cable Gland	PV connector	DC inside connector	Fuse PCB+ String detection board	DC surge arrester	DC switch	AC switch	AC surge arrester
Sofar 20000TL-S0 Sofar 17000TL-S0 Sofar 15000TL-S0 Sofar 10000TL-S0	√		√					
Sofar 20000TL-S1 Sofar 17000TL-S1 Sofar 15000TL-S1 Sofar 10000TL-S1	√		√			√		
Sofar 20000TL-S2 Sofar 17000TL-S2 Sofar 15000TL-S2 Sofar 10000TL-S2		√	√			√		
Sofar 20000TL-S3 Sofar 17000TL-S3 Sofar 15000TL-S3 Sofar 10000TL-S3		√		√		√		
Sofar 20000TL-S4 Sofar 17000TL-S4 Sofar 15000TL-S4 Sofar 10000TL-S4		√		√	√	√		
Sofar 20000TL-S5 Sofar 17000TL-S5 Sofar 15000TL-S5 Sofar 10000TL-S5		√		√	√	√		√
Sofar 20000TL-S6 Sofar 17000TL-S6 Sofar 15000TL-S6 Sofar 10000TL-S6		√		√	√	√	√	√

√ denote incorporating this component

Model Sofar 17000TL-Sx similar to Sofar 20000TL-Sx except amount of the DC-link capacitors, different of input and output sampling resistors and different inductance of Boost, invert inductor.

Model Sofar 15000TL-Sx similar to Sofar 17000TL-Sx except amount of the DC-link capacitors, different inductance of Boost, invert inductor and less PV input circuits (including PV terminal, fuse and sampling circuits of fuse).

Model Sofar 10000TL-Sx similiae to Sofar 15000TL-Sx except amount of the DC-link capacitors and boost diode, different of input and output sampling resistors and different inductance of Boost, invert inductor.

Model Sofar 20000TL-Sx and Sofar 17000TL-Sx have two external fans.

Model Sofar 15000TL-Sx has one external fan and model Sofar 10000TL-Sx has not.

Unless other special notes, only model Sofar 20000TL-S6 for testing.

Software setting as following:

Different country can be set on switch SWT3 on communication board, digit "0" represents OFF, digit "1" represents ON

SWITCH 5	SWITCH 4	SWITCH 3	SWITCH 2	SWITCH 1	Country
0	1	0	0	0	Belgium

C10/11			
Cl.	Requirement - Test	Result	Verdict
2	Grid connection		-
2.1	Agreement of the network operator Connection to the public grid is allowed in agreement with the network operator. Small generators are out of the official agreement process if: <ul style="list-style-type: none"> - single-phase units $< 5kVA_{max}$ - three-phase units $< 10kVA_{max}$ and the phase unbalance is limited to 20A - the generator has an integrated automatic disconnection device in accordance with 3.2 		-
2.2	General The network operator decides about the parallel coupling to the public grid.		-
2.3	Power transit The maximum acceptable transit power in a connection point is defined by the network operator		-
2,4	Type of connection <ul style="list-style-type: none"> - $>5kVA_{max}$ must be installed as a multi-phase system and the phase unbalance is limited to 20A - $\leq 5kVA_{max}$ can be connected in single- or multi-phase - A grounding of the neutral in the generator is not allowed 	Multi-phase inverter	P
2.4.1	Connection to the public low-voltage grid The voltage level shall be 230V/400V with or without neutral connection		P
2.4.2	Connection to the public medium-voltage grid Relevant if a connection without transformer is Planned.		N/A
2.5	(n-1)-Situations (only at medium-voltage Appliances) The power of the de-centralized generators shall not exceed the power of the LV/MV transformer		N/A
2.6	Contribution to the short-circuit power The short-circuit power of the final installation must be within certain limits		N/A
2.7	Transformer (only at medium-voltage appliances)		N/A
2.8	voltage-level, voltage-control and reactive power <ul style="list-style-type: none"> - generators ≤ 1 MVA: power factor $>0,95$ - generators >1 MVA: generator must be capable of providing a reactive power of $-0,1 P_{nom}$ and $0,33P_{nom}$ as defined by the network operator 		P

C10/11			
Cl.	Requirement - Test	Result	Verdict
2.9	Power fluctuations Abrupt power fluctuations shall not change the voltage-level by more than 3%	Refer to report No.130918055GZU-001, 130918055GZU-002 for details	P
2.10	Frequency control In order not to increase frequency instability that might lead to a blackout, the decentralized production plant must be able to change his power injection as a function of mains frequency. In case of frequency higher than the nominal, the decentralized production plant shall adapt its active power injection according to the principles described & 2.13.2.1 and & 2.13.2.2.	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
2.11	Islanding Islanding within an installation is not allowed. Clause 3. of the standard must be considered	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
2.12	Reconnection to the grid Reconnection after islanding is only allowed after a synchro-check, see 3.3.5	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
2.13	Grid faults		-
2.13.1	Grid voltage The generator shall technically be able to run at a grid tolerance of $\pm 10\%$ of V_{nom}		P
2.13.2	Grid frequency The generators shall technically be able to run at a grid frequency between 49,0Hz—51,0Hz and at least for 30 minutes at the frequency bands of 47,5Hz—49,0Hz and 51,0Hz and 51,5Hz.	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
2.13.2.1	Active power feed-in for overfrequency For a frequency between 50,02Hz—51,5Hz must the decentralized production plant be able to adapt the active power with a gradient of 40% of the power P_M (P_M momentary power when the frequency exceeds 50,2Hz).	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
2.13.2.1	Reconnection condition after overfrequency-disconnection The reconnection is allowed in band of 47,5Hz-50,05Hz after at least 60s with a limited rise of maximum 10% active power $P_{a_{max}}$ of the decentralized production plant per minute.	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
2.13.3	Low voltage ride through Generators >1 MVA shall technically be able to ride through low voltages as follows: 85% of V_{nom} for 1,5s 70% of V_{nom} for 0,2s Voltage below 70% shall cause a disconnection		N/A

C10/11			
Cl.	Requirement - Test	Result	Verdict
2.13.4	Short interruptions on voltage Short interruptions can be caused by automatic switching operations in the grid. Requirements for the generators are defined in item 3. of this standard		N/A
2.14	Flicker Relevant for wind generators	Refer to report No.1403227081GZU-001 complied with VDE-AR-N 4105:2011	P
2.15	Harmonics Harmonics shall not cause disturbances in the grid	Refer to report No.1403227081GZU-002, complied with VDE-AR-N 4105:2011	P
2.16	Un-symmetric grid load The generator shall not load the grid in an un-symmetric load condition		P
2.17	Capacitor bench The network operator can require a capacitor bench in the installation		N/A
2.18	Remote controlling Remote controlling of the units can be possible via power line communication		N/A
2.19	Combination of different generators On a multi-phase installation the unbalance shall be not more than 20A. If required by the network operator, multi-generator applications shall have different reconnection times		N/A
2.20	Communication Generators >1 MVA shall provide a communication interface according to IEC 61850		N/A
2.21	Energy Metering Not part of this technical guideline		-
3	Disconnection and monitoring devices		-
3.1	Block diagram		-
3.2	Disconnection system A disconnection device with insulating function which the distribution network operator can access at any time must be installed. Generators ≤10kVA can have an integrated automatic disconnection device according to Annex 4 of this standard. The requirement of an accessible disconnection device can be waived in this case.		P
3.3	Grid protection		P

C10/11			
Cl.	Requirement - Test	Result	Verdict
3.3.1	General Disconnection devices, other than defined in clause 3.2, must be tested according to clause 3.3 of this standard. In this context an immediate disconnection shall not exceed 120ms.	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
3.3.2	General protection for internal faults Generators must disconnect from the grid in case of internal faults		P
3.3.3	Disconnection device The disconnection system shall be fail-safe. A loss of control in the generator shall cause an immediate disconnection. The functionality is tested according to clause 4.2.3 of this standard	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
3.3.3.1	Connection to the medium-voltage grid General requirements to the disconnection device— — frequency relay with immediately disconnection if the frequency range exceeds $47,5\text{Hz} < f < 51,5\text{Hz}$; the DNO could ask adjustments in the specific frequency (between 47,5Hz and 51,5Hz), if justified for security reasons - 3 phase maximum voltage relay with immediately disconnection if the voltage exceeds a defined value. This value is $< 110\%$ of V_{nom} and is provided by the network operator - 3 phase minimum voltage relay with disconnection within 1,5s if the voltage is in the range of 50-85% of of V_{nom} - 3 phase minimum voltage relay with immediately disconnection if the voltage is in the range of 25-50% of of V_{nom} -detection of islanding by implementation of one of the following: vector jump of more than 70 or df/dt by 1 Hz/s		N/A
3.3.3.2	Connection to the low-voltage grid		-

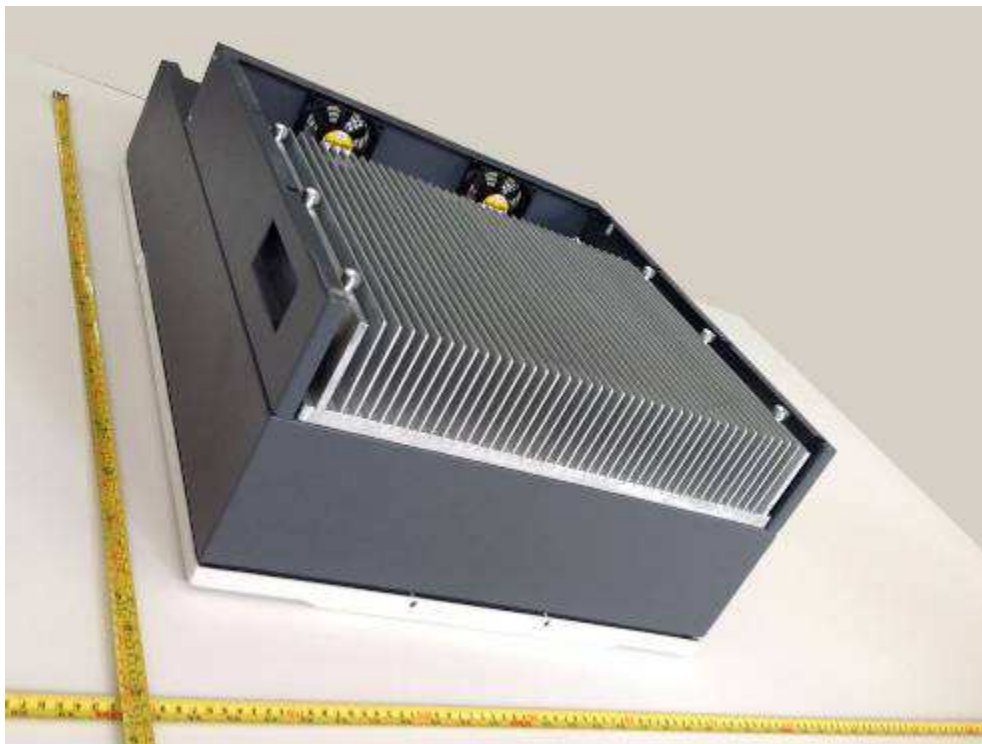
C10/11			
Cl.	Requirement - Test	Result	Verdict
3.3.3.2.1	<p>General case</p> <ul style="list-style-type: none"> - frequency relay with immediately disconnection if the frequency range exceeds 47,5Hz<f<51,5Hz: the DNO could ask adjustments in the specific frequency (between 47,5Hz and 51,5Hz), if justified for security reasons - 1 or 3 phase maximum voltage relay with immediately disconnection if the voltage exceeds a defined value. This value is <110% of Vnom and is provided by the network operator - 3 phase minimum voltage relay with disconnection within 1,5s if the voltage is in the range of 50-85% of of Vnom - 3 phase minimum voltage relay with immediately disconnection if the voltage is in the range of 25-50% of of Vnom - detection of islanding by implementation of one of the following: vector jump of more than 70 or df/dt by 1Hz/s 	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
3.3.3.2.2	<p>Generator power <10kVA and not able to run in islanding-mode</p> <p>Monitoring of maximum and minimum voltage</p>		N/A
3.3.4	Overview		-
3.3.5	<p>Synchro-check</p> <p>Grid parallel operation is only allowed if a synchronization device is installed. At generators <10kVA this can be waived</p>		N/A
3.3.6	<p>Voltage detector</p> <p>Used in medium-voltage appliances to avoid a possible asynchronous connection to the grid</p>		N/A
3.3.7	<p>DC-injection</p> <p>The generator shall not inject more than 1% of its nominal ac-current as a dc-component permanently to the grid. As an alternative a dc-injection monitoring can be implemented which detects the 1% within 200ms and causes a disconnection</p>	Refer to report No.1403227081GZU-002, complied with DIN V VDE V 0126-1-1:2013.08	P
3.3.8	Direction-sensitive protection		N/A
3.3.9	<p>Additional protection on the medium-voltage side</p> <p>Can be required by the network operator</p>		N/A
3.3.10	<p>Other protections</p> <p>The aforementioned protections are the technical minimum requirements. In any case the network operator can request special features</p>		P
4	Procedure for the industrial commissioning		-

C10/11			
Cl.	Requirement - Test	Result	Verdict
5	Operation		-
Annex 1	EMC relevant standards (EN/IEC 61000-series is applicable)	Refer to report No.130918055GZU-001, 130918055GZU-002 for details	P
Annex 2	Voltage plan		N/A
Annex 3	Example wind turbine		N/A
Annex 4	Automatic disconnection facility		P

Appendix 1: Photos



Overall view of the unit



Bottom view of the unit

Appendix 1: Photos

PV connector (Sofar 20000TL-Sx and Sofar 17000TL-Sx has 3x2 pairs)
(Sofar 15000TL-Sx and Sofar 10000TL-Sx has 2x2 pairs)



Terminals view of the unit (for models "-S2" to "-S6")



Terminals view of the unit (without AC switch)

Appendix 1: Photos



Terminals view of the unit for model Sofar 10000TL-Sx



Terminals view of the unit (for models "-S0" to "-S1")

Appendix 1: Photos

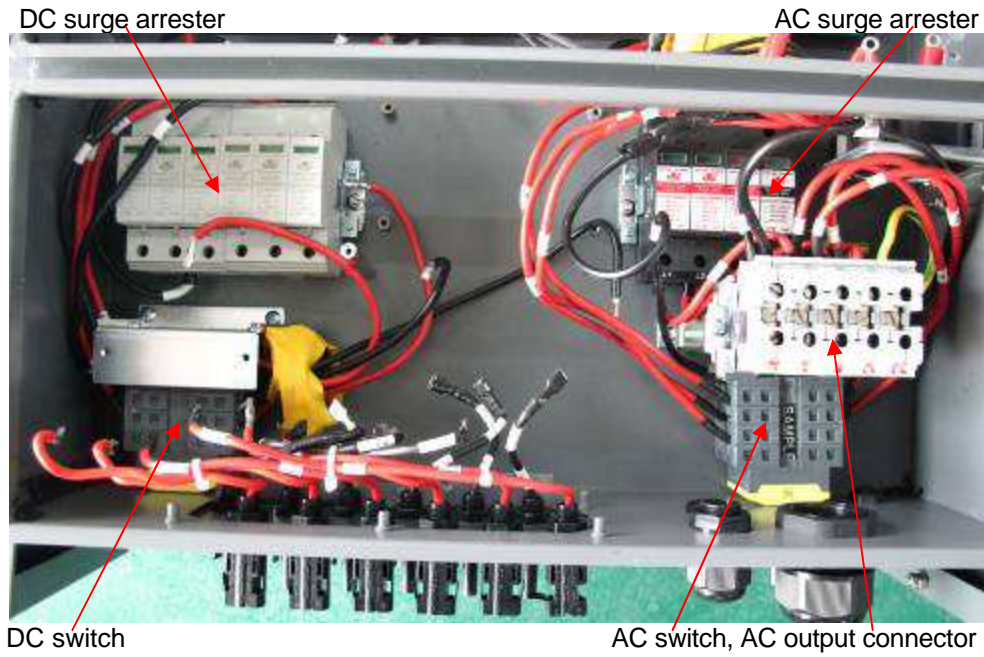


Internal view of the unit



Internal view of the unit

Appendix 1: Photos



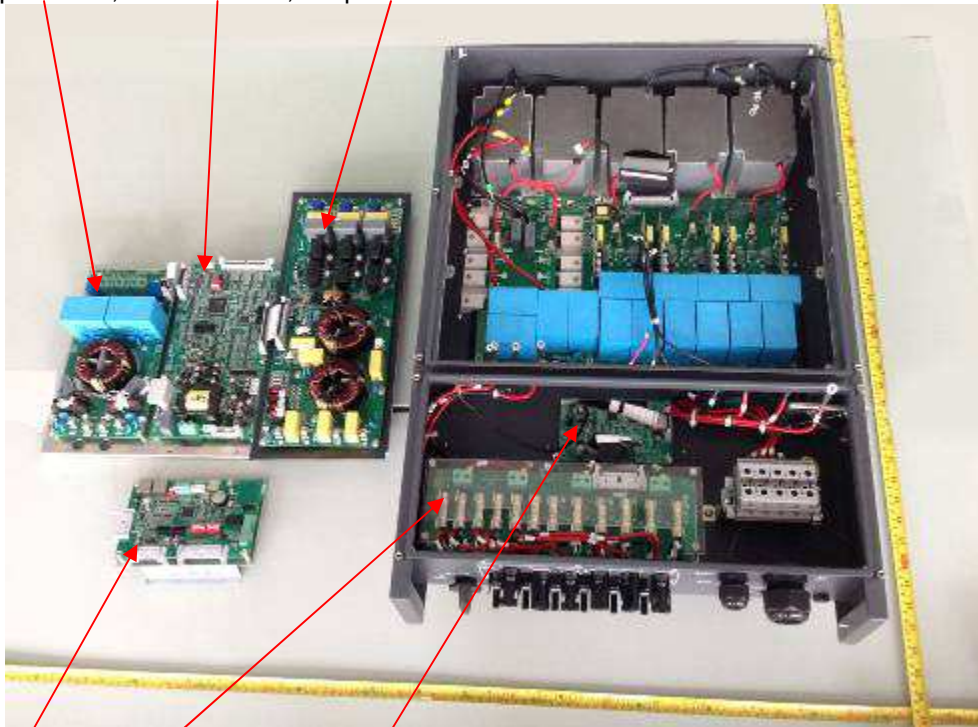
Internal view of the unit



Internal view of the unit

Appendix 1: Photos

Input board, Control board, Output board



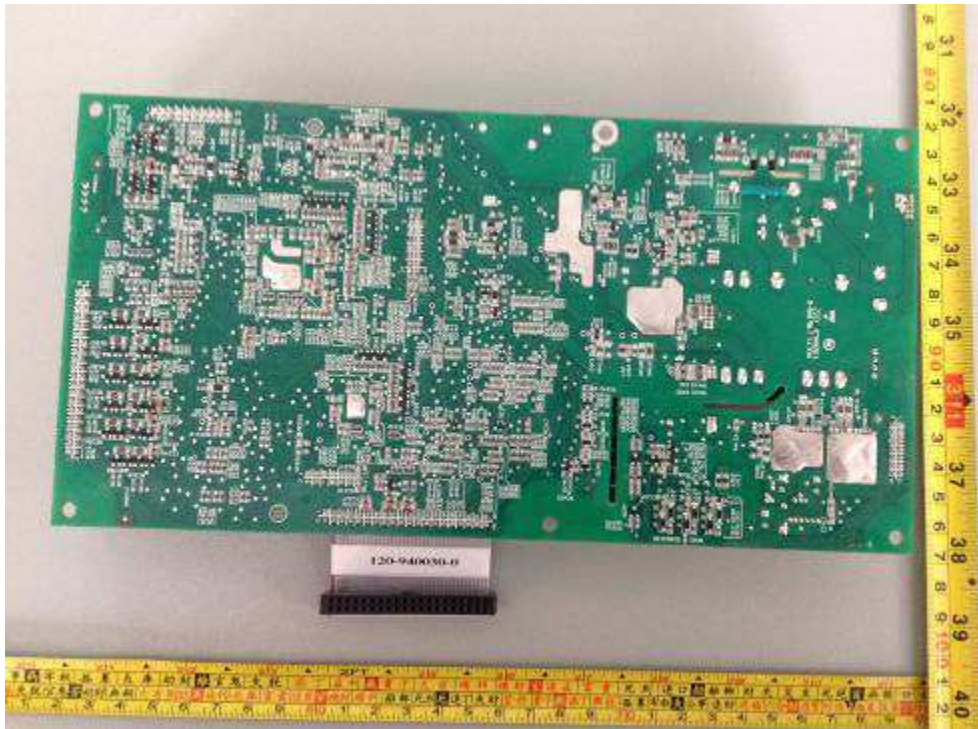
COM board, Fuse board, String detection board

Internal view of the unit



Front view of the control board

Appendix 1: Photos



Bottom view of the control board
(End of report)