TEST REPORT
DIN V VDE V 0126-1-1:2013.08
Automatic disconnecting device

Report Reference No. ..... :	160816043GZU-001
Date of issue ..... :	27 Sep. 2016
Total number of pages	27 pages
Testing Laboratory ..... :	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/ address .....:	Same as above
Tested by (name + signature) .....:	Jason Fu
Approved by (+ signature) .....:	Tommy Zhong
Applicant's name ..... :	SHENZHEN GROWATT NEW ENERGY TECHNOLOGY CO., LTD
Address ..... :	1st East & 3rd Floor of Building A, Building B, Jiayu Industrial Park, #28, GuangHui Road, LongTeng Community, Shiyan Street, Baoan District, Shenzhen, P.R.China
Test specification:	
Standard ..... :	DIN V VDE V 0126-1-1:2013.08
Test procedure ..... :	Type test
Non-standard test method.....:	N/A
Test Report Form No. ..... :	VDE0126-1-1b
Test Report Form(s) Originator..... :	Intertek
Master TRF ..... :	Dated 2013-09

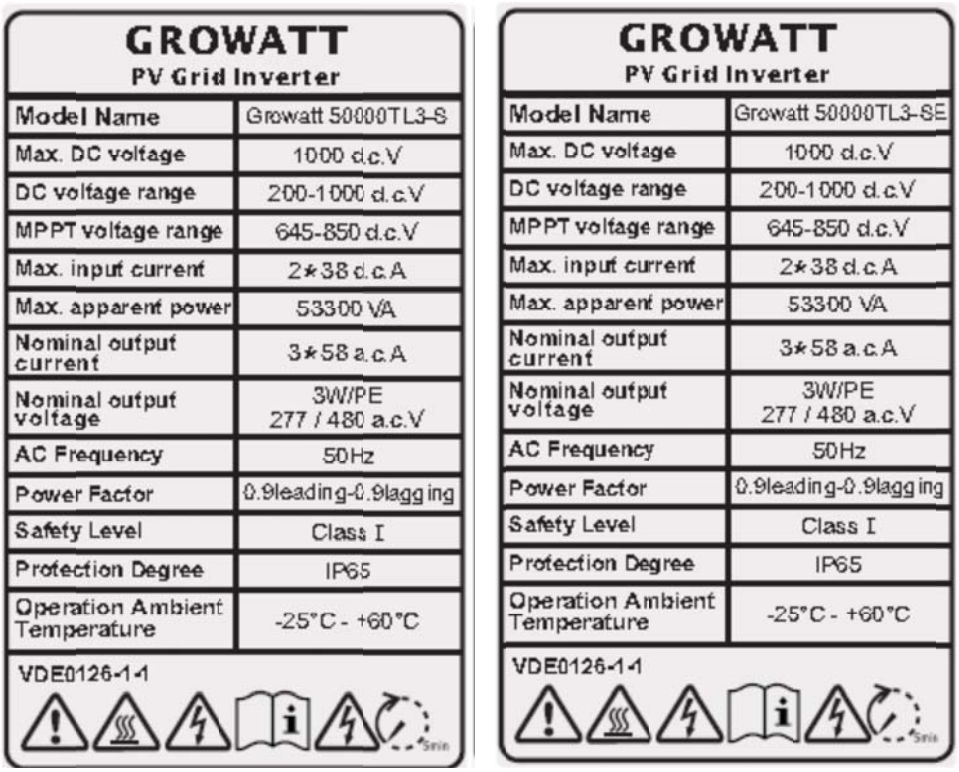
Test item description .....:	PV Grid inverter
Trade Mark..... :	GROWATT
Manufacturer..... :	Same as Applicant
Model/Type reference..... :	Growatt 30000TL3-S, Growatt 30000TL3-SE Growatt 33000TL3-S, Growatt 33000TL3-SE Growatt 40000TL3-NS, Growatt 40000TL3-NSE Growatt 50000TL3-S, Growatt 50000TL3-SE

Rating……:	Model	Growatt 30000TL3-S, Growatt 30000TL3-SE	Growatt 33000TL3-S, Growatt 33000TL3-SE	Growatt 40000TL3-NS, Growatt 40000TL3-NSE	Growatt 50000TL3-S, Growatt 50000TL3-SE
	Input				
	Max. DC input Voltage:	1000Vdc			
	Max. input current:	34A/34A	38A/38A		
	DC input range:	200-1000Vdc			
	MPPT Voltage Rang	450-800Vdc		540-800Vdc	645-800Vdc
	Output				
	Nominal AC output voltage:	3W/N/PE, 230/400Vac			3W/PE, 480Vac
	Nominal frequency:	50Hz			
	AC output power:	33300VA	36600VA	44400VA	53300VA
	Nominal AC output current:	3*44A	3*48A	3*58A	3*58A
	Power factor:	0.9 Leading – 0.9 Lagging			
	Ingress protection:	IP65			
	Protection Class:	Class I			
	Operation Ambient Temp.:	-25℃ to +60℃			

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All applicable test items.	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

Copy of marking plate(representative):



GROWATT PV Grid Inverter	
Model Name	Growatt 50000TL3-S
Max. DC voltage	1000 d.c.V
DC voltage range	200-1000 d.c.V
MPPT voltage range	645-850 d.c.V
Max. input current	2*38 d.c.A
Max. apparent power	53300 VA
Nominal output current	3*58 a.c.A
Nominal output voltage	3W/PE 277 / 480 a.c.V
AC Frequency	50Hz
Power Factor	0.9leading-0.9lagging
Safety Level	Class I
Protection Degree	IP65
Operation Ambient Temperature	-25°C - +60°C
VDE0126-1-1	

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which o not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. Other markings same as Growatt 50000TL3-S, Growatt 50000TL3-SE except model name and ratings

Test item particulars.....:	
Temperature range .....:	-25°C ~ 60 °C
Overvoltage category.....:	☐ OVC I ☒ OVC II (for PV input) ☒ OVC III (for main) ☐ OVC IV
IP protection class .....:	IP65
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement .....:	P (Pass)
- test object does not meet the requirement .....:	F (Fail)

Testing ..... :	
Date of receipt of test item ..... :	16 Aug., 2016
Date (s) of performance of tests ..... :	16 Aug., 2016 – 14 Sep., 2016

General remarks:

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.

Throughout this report a point is used as the decimal separator.

Clause numbers in parentheses derive from VDE-AR-N 4105:2011-08.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through terminal. The structure of the unit complied with the IP 65 requirement.

The inverters intended to operate at ambient temperature -25℃ - +60℃, which will be specified in the user manual, however, the inverters will output full power when operated at 45℃, if operated at high than 45℃ temperature, the output power would be derate.

For all model, The DC startup voltage is 250Vdc, and inverter does not start when input voltage larger than 1000V

For model Growatt 30000TL3-S, Growatt 30000TL3-SE, Growatt 33000TL3-S, Growatt 33000TL3-SE , Growatt 40000TL3-NS, Growatt 40000TL3-NSE, if the DC input higher than 800Vdc the output power would be derate;

For model Growatt 50000TL3-S, Growatt 50000TL3-SE, if the DC input higher than 850Vdc the output power would be derate;

For model Growatt 30000TL3-S, Growatt 30000TL3-SE, Growatt 33000TL3-S, Growatt 33000TL3-SE , if the DC input lower than 450Vdc the output power would be derate;

For model Growatt 40000TL3-NS, Growatt 40000TL3-NSE, if the DC input lower than 540Vdc the output power would be derate;

For model Growatt 50000TL3-S, Growatt 50000TL3-SE, if the DC input lower than 645Vdc the output power would be derate;

All models have identical mechanical and electrical construction except some parameter of the software architecture in order to control the max output power. The detailed difference as following:

Model	Junction Box	DC fuse	PID board	PV string monitoring
Growatt 30000TL3-S, Growatt 33000TL3-S, Growatt 40000TL3-NS, Growatt 50000TL3-S	√	√	√	√
Growatt 30000TL3-SE, Growatt 33000TL3-SE, Growatt 40000TL3-NSE, Growatt 50000TL3-SE				
√denotes incorporating this component and function.				

Model Growatt 30000TL3-S, Growatt 30000TL3-SE, Growatt 33000TL3-S, Growatt 33000TL3-SE, Growatt 40000TL3-NS, Growatt 40000TL3-NSE are non-isolated inverter; Model Growatt 50000TL3-S and Growatt 50000TL3-SE are isolated inverter, which output shall be connected with isolated transformer.

Other than special notice, the model Growatt 40000TL3-NS is as the representative test models in this report

Factory information:

SHENZHEN GROWATT NEW ENERGY TECHNOLOGY CO., LTD

1st East & 3rd Floor of Building A, Building B, Jiayu Industrial Park, #28, GuangHui Road, LongTeng Community, Shiyan Street, Baoan District, Shenzhen, P.R.China

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
4	**REQUIREMENTS**		P
4.0	**General**		P
	These requirements apply to integrated or separate (independent) disconnecting devices unless otherwise noted. The disconnection device has to cut off the power generating system on the ac side from the grid by two switches in series when: — the voltage and/or the frequency of the grid is deviating, — direct current (DC) is fed into the Grid. — unintentional islanding operation occurs, — intentional islanding operation using grid backup systems (emergency supplies).		P
4.1	**Functional safety**		P
	The safety must be assured under all operating conditions complying with the defined functions 4.3 to 4.6 and – if applicable – 4.8 of the disconnection device. The disconnection device can be an independent unit or an integrated part of the power generating unit and must switch off in case of a fault and indicate the fault status	Considered, see annex. The single fault safe system was reviewed. The theoretical investigation was verified by error simulation.	P
4.1.1	**Single fault tolerance**		P
	The disconnection device must comply with the single fault tolerance requirements of VDE-AR-N 4105:2011-08, A.6	Considered, functional explanation and table 6.1 below.	P
4.1.2	**Interface Switch**		P
	The interface switch must, in case it is integrated into a PV-inverter, comply with the requirements of DIN EN 62109-2(VDE 0126-14-2):2012-04, 4.4.4.15.2 and in all other cases with the requirements according to VDE-AR-N 4105:2011-08, 6.4.	Disconnection takes place redundant through two relays and the IGBT-full bridge in series. The relays and the IGBT-full bridge are able to switch the full current.	P
(6.4.1)	**General**		P
	For the connection of the power generation system to the network operator's low-voltage network or to the remaining customer system, it is necessary to use an interface switch. It consists of two electric switching devices connected in series and shall thus be constructed redundantly. The interface switch is controlled by the NS protection and activates automatically if at least one protective function responds. The breaking devices of the interface switch shall be designed to be short-circuit proof and shall be releasable without delay and with due regard to the protective devices required by clause 6.5. The breaking		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	capacity of the two breaking devices of the interface switch shall be dimensioned at least in accordance with the responding range of the upstream safety fuse or the maximum short-circuit current contribution of the power generation system. Switches with at least breaking capacity shall be use for both breaking devices of the interface switch. In addition to that, all-pole disconnection shall be ensured.		
(6.4.2)	**Central interface switch**		N/A
	The two break devices of the central interface switch shall be executed as galvanic break devices. The two break devices of the interface switch shall be installed directly at the central meter panel in the circuit distributor of the power generation system.		N/A
(6.4.3)	**Integrated interface switch**		P
	Construction of the interface switch shall be carried out taking into consideration the single-fault tolerance. An interface switch ensures a single-fault tolerant all-phase galvanic breaking. For power generation systems with inverters, the interface switch shall be provided on the inverter's network side. A short circuit in the inverter shall not impair the switching function of the interface switch.		P
4.2	**Connection conditions**		P
	The connection, the reconnection after a grid-fault and the reconnection after short interruption shall be carried out according to VDE-AR-N 4105:2011-08, 8.3.1		P
(8.3.1)	**General**		P
	A power generation system shall be connected to the network operator's network only if a suitable device determines that both the mains voltage and the mains frequency are within the tolerance range of 85 % Un to 110 % Un or 47.5 Hz to 50.05 Hz, respectively, for a period of at least 60 seconds. If decoupling protection devices are tripped because of a short interruption, then the power generation system is permitted to already reconnect as soon as the mains voltage and mains frequency have uninterruptedly remained within the tolerance ranges given above for a period of 5 seconds. Short time interruptions are characterised by the NS protection settings of the mains frequency and/ or network voltage being exceeded or undershot for a maximum period of 3 seconds. The power generation system being reconnected to the network operator's network at the tripping of the decoupling protection device, the active power of controllable power generation systems supplied to the network operator's network shall not exceed the	Tested with a variable AC-Power supply at the output. Inverter disconnects within the limits, see table 6.2 below.	P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	gradient of 10 % of the active power per minute.		
4.3	**Monitoring the voltage**		P
4.3.1	**voltage drop U<**		P
	The disconnection because of a voltage drop shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.3.2	**rise-in-voltage U>>**		P
	The disconnection because of a rise-in-voltage shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.3.3	**slow rise-in-voltage U>**		P
	The disconnection because of a slow rise-in-voltage (10-minute-average) shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.4	**Monitoring the frequency**		P
	The disconnection because of a frequency decrease or a frequency increase shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
(6.5.1)	**General**		P
	The purpose of the NS protection is to disconnect the power generation system from the net in the event of inadmissible voltage and frequency values. This is intended to prevent an unintentional feed-in of the power generation system into a power-supply unit separated from the remaining distribution network as well as the feed-in of faults within this network. The system operator shall himself take precautions to prevent damages to his systems and installations as might be caused by switching actions, voltage fluctuations and automatic reclosings in the network connected upstream or other process in the network of the network operator. The following functions of the decoupling protection shall be implemented: - Voltage drop protection *U* <; - Rise-in-voltage protection *U* >; - Rise-in-voltage protection *U* >>; - Frequency decrease protection *f* <; - Frequency increase protection *f* >; - Islanding detection. The setting values of the protective functions and the last five dated failure reports shall be readable at the NS protection. Interruptions of supply with durations of 3 s or longer shall not lead to loss of any of the failure reports. Read-out shall be possible at the central NS protection irrespective of the operational state of the		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	power generation system and without any additional aids. For integrated NS protection read-out may be carried out using a data interface.		
(6.5.2)	**Protective functions**		P
	The protective functions of the NS protection shall be designed so that the disconnection time (the sum of the proper times of NS protection and interface switch plus a delay for the protection relay, which may or may not be adjustable) does not exceed 200 ms.		P
4.5	**Monitoring the dc current**		P
	A feed in of d.c current into the low-voltage grid due to defective equipment must lead to a switch off within 0.2 seconds. For this purpose the fault itself or a measurement of the dc component of the current exceeding 1 A can be used as disconnection criteria.	See appended table below.	P
4.6	**Detection of islanding operation**		P
	The disconnection because of a detection of unintended islanding operation shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.3	See appended table below.	P
(6.5.3)	**Islanding detection**		P
	The islanding detection is implemented in the central NS protection or in the integrated NS protection of the power generation unit. If an islanding detection system acting on the integrated interface switch is integrated in all power generation units of a power generation system, then it is permitted to omit the islanding detection in the central NS protection regardless of the system power. Detection of an isolated network and disconnection of the power generation system by means of the interface switch shall be completed within 5 seconds.	See appended table below.	P
4.7	**Markings**		P
	A generating system equipped with an automatic disconnecting device shall be marked with the information “VDE 0126-1-1” which is visible from the outside. This can be done by — the marking plate or — showing it on a display of the disconnection device or — a separate marking		P
4.8	**Requirements for disconnection devices integrated into PV-inverters**		P
	The requirements of the DIN EN 62109-2 (VDE 0126-14-2):2012-04, 4.8 regarding the residual current detection and the insulation detection of the PV-generator shall be complied with.		P

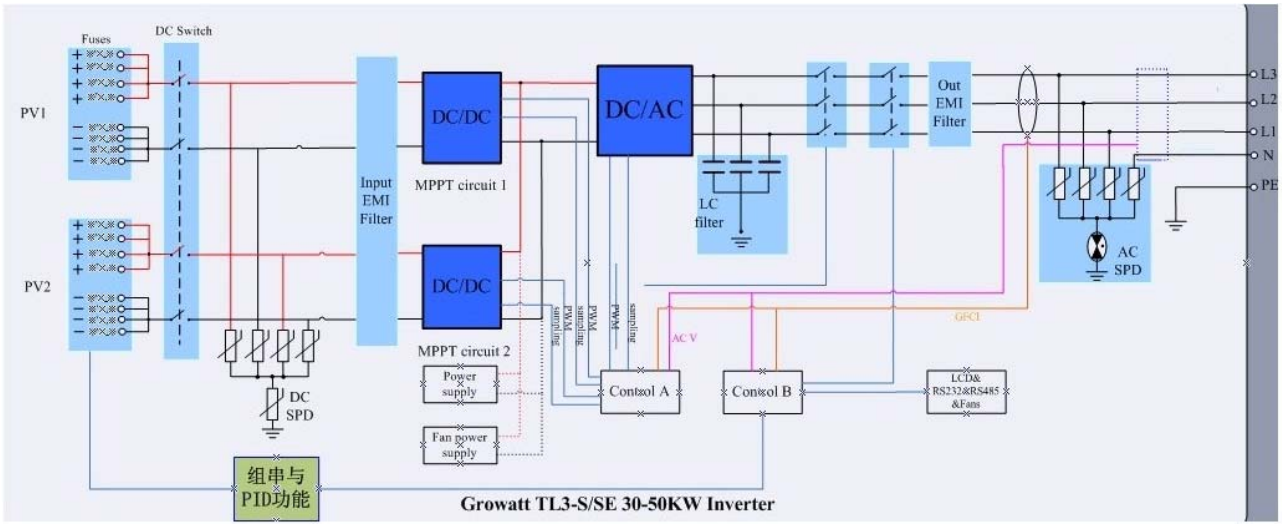
DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
5	**General Requirements**		P
	Limits according to DIN EN 61000-6-3 (VDE 0839-6-3) regarding radio interferences must be complied with. For disturbance-free operation disturbance limits according to DIN EN 61000-6-2 (VDE 0839-6-2) shall be complied with.		P
6	**TYPE TESTING**		**P**
6.0	**General**		P
	The following tests are valid for integrated and separated disconnecting devices unless otherwise noted. A separate disconnection device must be tested together with a suitable supply. It has to be ensured that the turn-off signal is caused by the disconnection device and not by the supply.	See following test report	P
6.1	**Functional safety**		P
	The testing of the single fault tolerance and the error detection with following disconnection according to 4.1 is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.2.		P
6.2	**Connection conditions**		P
	The testing of the connection and the reconnection is carried out according to DIN VDE V 0124-100 (VDE V 0124):2012-07, 5.5.1 and 5.5.2.		P
6.3	**Monitoring the voltage**		P
	The testing of the voltage monitoring is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.3.		P
6.4	**Monitoring the frequency**		P
	The testing of the frequency monitoring is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.4.		P
6.5	**Monitoring the dc current**		P
	The testing of the disconnection due to feed in of direct current is carried out either by a) or b): a) The measuring device at the switching point (e.g. current transformer or resistance) is fed with direct current of 1 A. The cut-off must be carried out within 0.2 seconds. b) By means of a fault simulation it is measured if a defective system operation with a d.c. fault current of more than 1 A leads to cut-off within 0.2 seconds.		P
6.6	**Detection of islanding operation**		P
	The testing of the disconnection due to unintended islanding operation is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.6.		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
7	**Routine Test**		**P**
	The manufacturer has to carry out routine tests regarding all safety relevant functions before delivering an automatic disconnection device.		P
8	**Construction Specification**		**P**
	Initial tests and re-examination in addition to the routine tests may be omitted. If the disconnection device is a separate unit it must not be used in a TN-C power system. In this case a TN-C-S power system must be created.		P

6.1 (5.4.5.1 & 5.4.5.2)	TABLE: General requirements	P

Design of functional safety:

The internal control is redundant built. It consists of Microcontroller main CPU (Control A) and slave CPU (Control B).
The main CPU control the relays by switching signals; measures the PV voltage, current and voltage, measures grid voltage, frequency, AC current with injected DC and the array insulation resistance to ground. In addition it tests the current sensors and the RCMU circuit before each start up.
The CPU (Control B) is measures the grid voltage and residual current measuring, also can switch off the relays independently, and communicate with CPU (Control A) each other.
The current is measured by a current sensor. The AC current signal and the injected DC current signal are sent to the main CPU. The main CPU tests and calibrates before each start up all current sensors.
The unit provides two relays in series in all output conductors. When single fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the PV array and the mains. All the relays are tested before each start up.



6.1 (6.5.1)			TABLE: General requirements				
String	1	U_{DC} = Un	580Vdc	Uac = Un	230 Vac	P = (W)	40000

Component No.	Fault	Observation
Relay defect RY1 “L”	Short before start up	Error message “Error: 117” (Relay fault). PV inverter did not connect and feed power to grid immediately.
Relay defect RY1 “N”	Short before start up	Error message “Error: 117” (Relay fault). PV inverter did not connect and feed power to grid immediately.
Relay defect RY2 “L”	Short before start up	Error message “Error: 117” (Relay fault). PV inverter did not connect and feed power to grid immediately.
Relay defect RY2 “N”	Short before start up	Error message “Error: 117” (Relay fault). PV inverter did not connect and feed power to grid immediately.
GFCI	Defeat of power	PCE protected, and disconnect from grid. Indicate “Residual I High”. No hazard
C286	S/C	PCE protected, and disconnect from grid. Indicate “Residual I High”. No hazard
Q1(2-3)	S/C	PCE protected immediately, Error message: "Error 117". PCE disconnect from the grid immediately, no output , no hazard

Q1(1-2)	S/C	PCE protected immediately, Error message: "Error 117". PCE disconnect from the grid immediately, no output , no hazard
Grid voltage Monitoring defect	O-C	Error message “Error: 102” (Data received by master and slave processor are different). PV inverter disconnected from grid immediately.
Grid voltage Monitoring defect	S-C	Error message “Error: 102” (Data received by master and slave processor are different). PV inverter disconnected from grid immediately.
Frequency Monitoring defect	O-C	Error message “AC F outrange”. PV inverter disconnected from grid immediately
Loss of control (Control B)	O-C	LCD lighting flash. PV inverter disconnected from grid immediately.

Supplementary information:

S-C: Short circuit, O-C: Open circuit

During the test:
Fire do not propagates beyond the EUT;
Equipment do not emit molten metal;
Enclosures do not deform to cause non-compliance with the standard.

Pass the dielectric test.

6.2 (5.5.1)	**Connection conditions**		**P**
For Growatt 40000TL3-NS			
DC input:	AC output:		Rated Output Power
580Vdc	230Vac; 50Hz		40000W
Measure Item	Reconnection?		Reconnection Time (>60s)
f_{ist} = 47,45Hz	☐ Yes	☒ No	Cannot reconnection
f_{ist} ≥ 47,55Hz	☒ Yes	☐ No	82.3s
f_{ist} = 50,1Hz	☐ Yes	☒ No	Cannot reconnection
f_{ist} ≤ 50,0Hz	☒ Yes	☐ No	82.0s
U_{ist} < 85% U_n	☐ Yes	☒ No	Cannot reconnection
U_{ist} ≥ 85% U_n	☒ Yes	☐ No	82.1s
U_{ist} > 110% U_n	☐ Yes	☒ No	Cannot reconnection
U_{ist} ≤ 110% U_n	☒ Yes	☐ No	82.2s

6.2 (5.5.2)	**Short-time Interruption**		**P**
For Growatt 40000TL3-NS			
	Reconnection time		
	1	2	3
After 2s of 77% Un	6.3s	6.3s	6.4s
After 4s of 77% Un	82.3s	82.3s	82.3s

6.3 (5.4.5.3)	**Monitoring the voltage (Results of Voltage monitoring)**		**P**
For Growatt 40000TL3-NS			
Rated Voltage (Un)	230Vac	Rated Frequency	50Hz
	1	2	3
118% Un (R phase)	97.00ms	106.25ms	95.25ms
118% Un (S phase)	106.50ms	85.00ms	104.50ms

118% Un (T phase)	87.75ms	113.90ms	128.80ms
118% Un (RST phase)	109.00ms	137.40ms	116.00ms
77% Un (R phase)	51.75ms	51.25ms	49.00ms
77% Un (S phase)	116.00ms	116.25ms	92.75ms
77% Un (T phase)	165.75ms	151.25ms	164.00ms
77% Un (RST phase)	100.75ms	103.50ms	92.75ms

6.3 (5.4.5.3)	**Monitoring the voltage (Results of the Protection of the Increase in Voltage as 10-min moving average)**		**P**
	Output Voltage （V）	Switch	
		On/Off state Finally	Time until Switch off (s)
100% Un	230.0	☒On ☐Off	Work normally
112% Un	257.6	☐On ☒Off	492.3
100% Un	230.0	☒On ☐Off	Work normally
108% Un	248.4	☒On ☐Off	Work normally
106% Un	243.8	☒On ☐Off	Work normally
114% Un	262.2	☐On ☒Off	273.6

6.4 (5.4.5.4)	**Monitoring the frequency**					**P**
	1		2		3	
	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)
Frequency decrease	47.52	186.8	47.52	188.0	47.52	177.0
Frequency increase	51.52	166.0	51.52	156.0	51.52	150.0

6.5	**TABLE: Monitoring the dc current**	**P**
P = 0.25 P_N= (W)	10000W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	40.25ms	
P = 0.5 P_N= (W)	20000W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	40.75ms	
P = 1.0 P_N= (W)	40000W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	40.25ms	

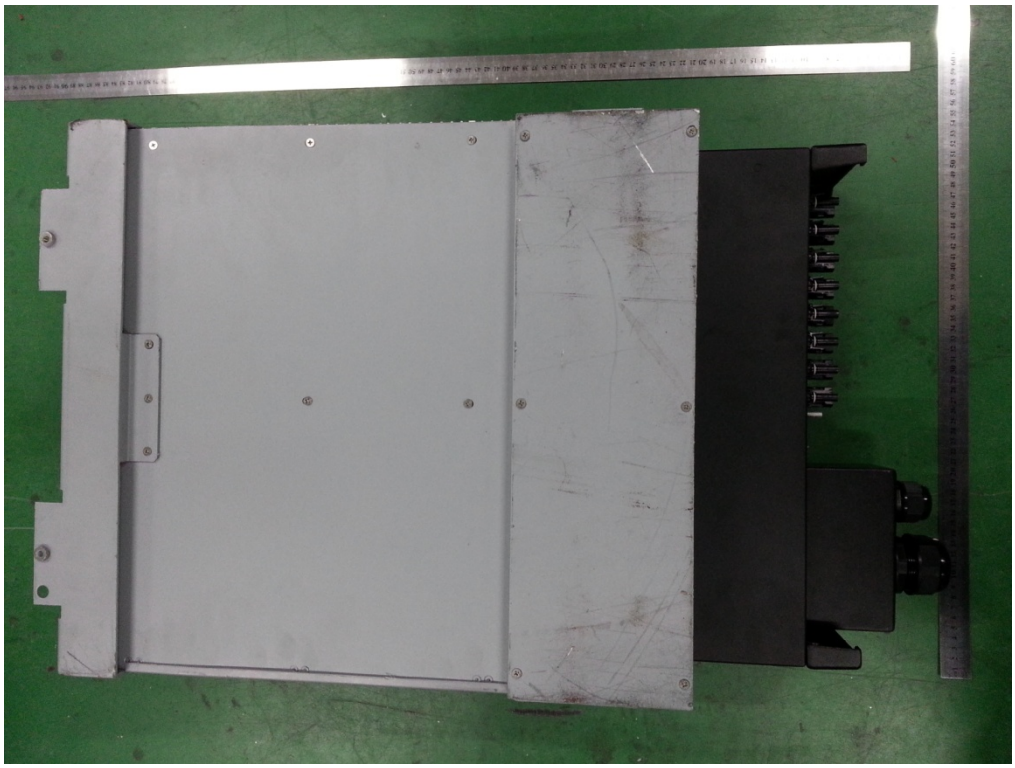
6.6 (5.4.6)	TABLE: Detection of islanding operation				P
Test conditions:	Frequency: 50+/-0,2Hz U_N=230+/-3Vac RLC consumes inverter real power within +/-3% Distortion factor of chokes <3% Quality Q>2				
P = 1.0 P_N = (W)	40000W	P = 0.5 P_N = (W)	20000W	P = 0.25 P_N = (W)	10000W
Q_L = 81428Var	Cut-off time (ms)	Q_L = 40253Var	Cut-off time (ms)	Q_L = 20710Var	Cut-off time (ms)
95%	122.0	95%	98.5	95%	92.0
96%	116.0	96%	99.0	96%	84.0
97%	122.0	97%	105.0	97%	102.0
98%	118.0	98%	115.0	98%	110.5
99%	98.0	99%	141.0	99%	117.5
100%	97.0	100%	168.0	100%	124.0
101%	182.0	101%	102.5	101%	81.5
102%	504.5	102%	100.5	102%	90.5
103%	178.0	103%	90.0	103%	76.5
104%	110.5	104%	97.0	104%	76.0
105%	110.0	105%	88.0	105%	69.5

Appendix photos

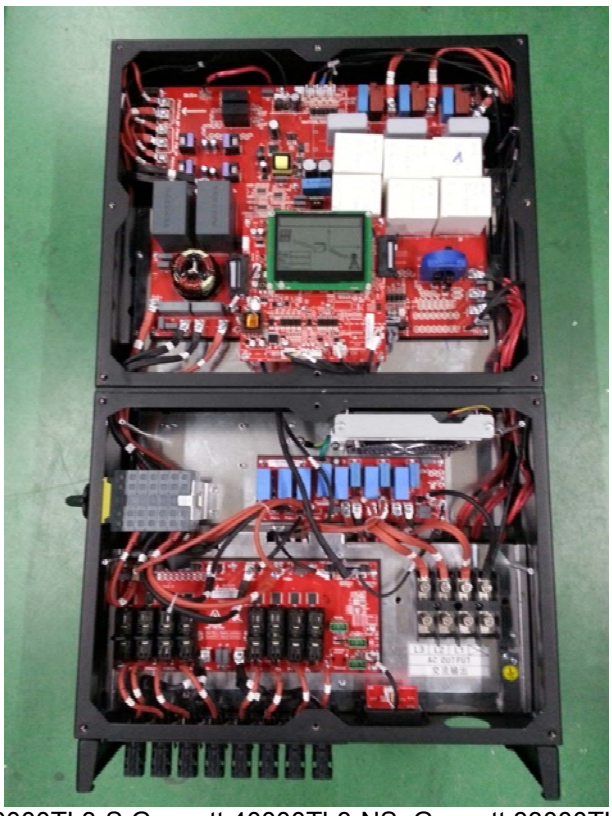
Top view of Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S

Top view of the models Growatt 50000TL3-SE, Growatt 40000TL3-NSE, Growatt 33000TL3-SE, Growatt 30000TL3-SE

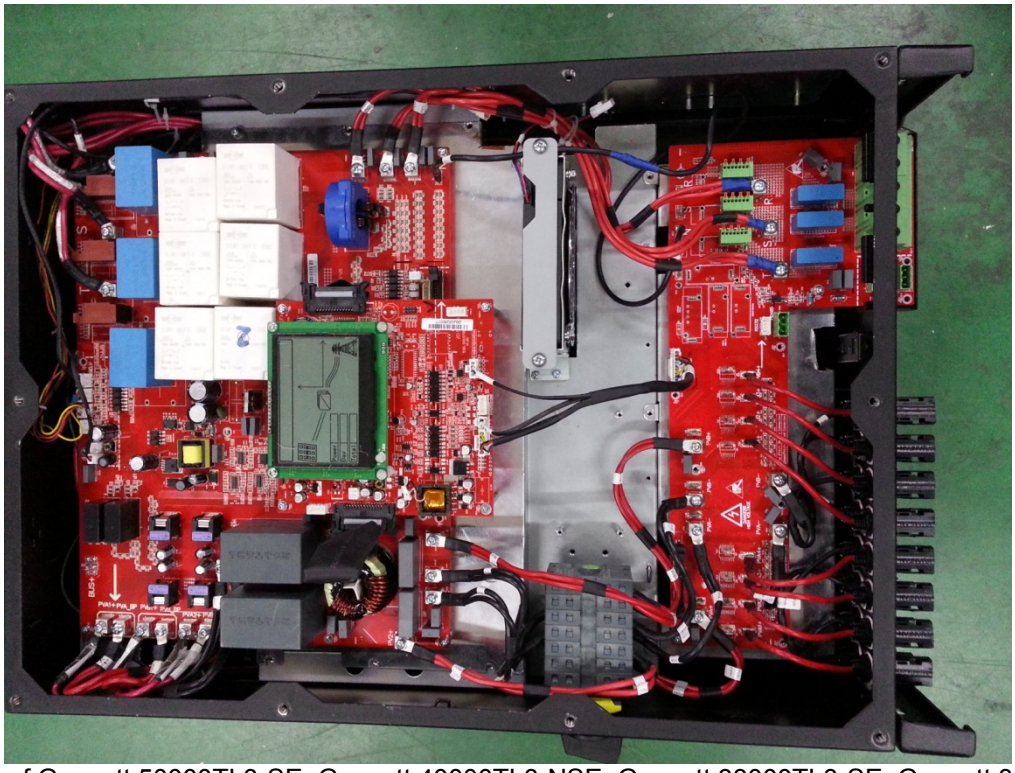
Side view of the models Growatt 50000TL3-SE, Growatt 40000TL3-NSE, Growatt 33000TL3-SE, Growatt 30000TL3-SE



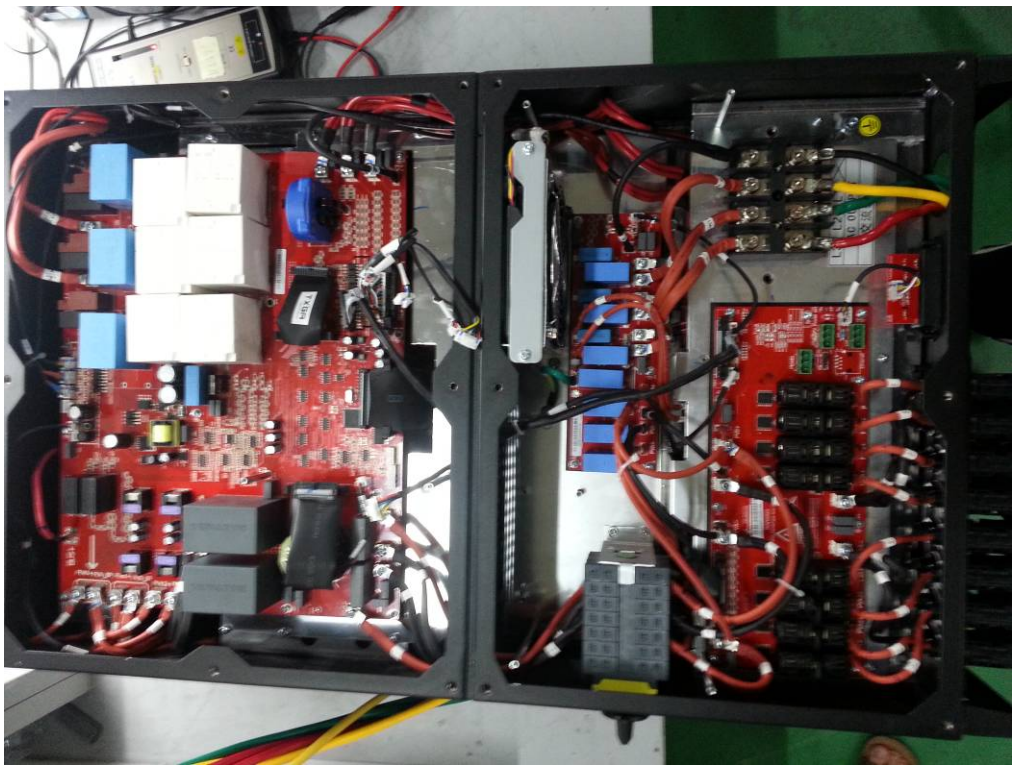
Buttom view for all models



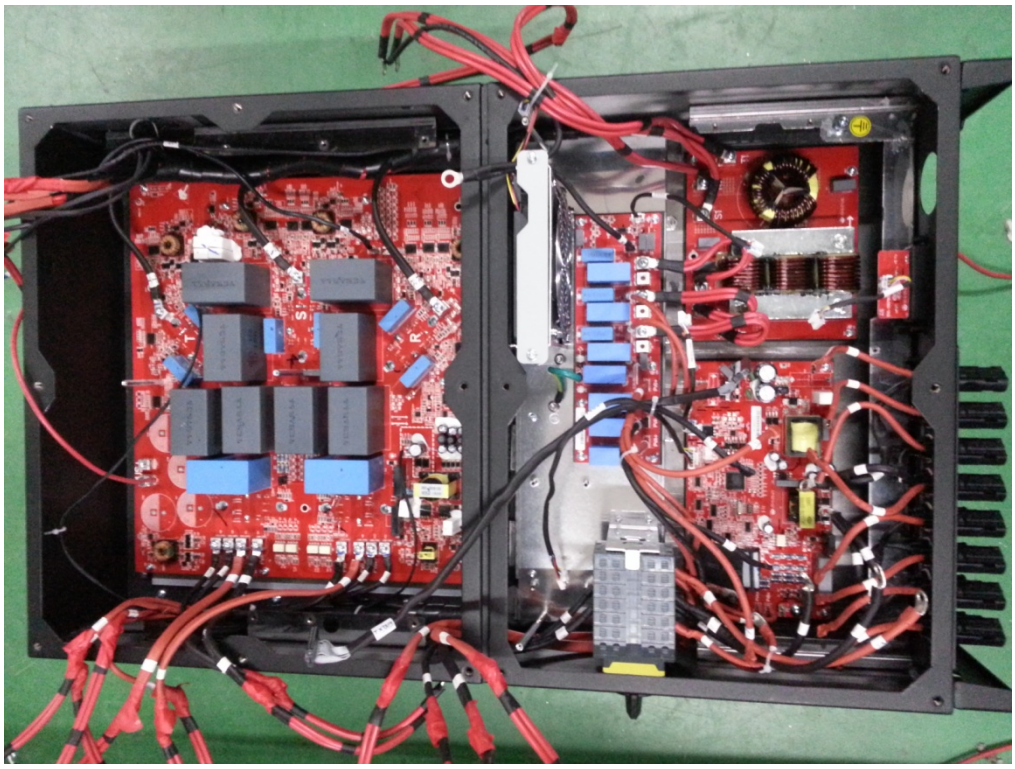
Internal view of Growatt 50000TL3-S,Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S



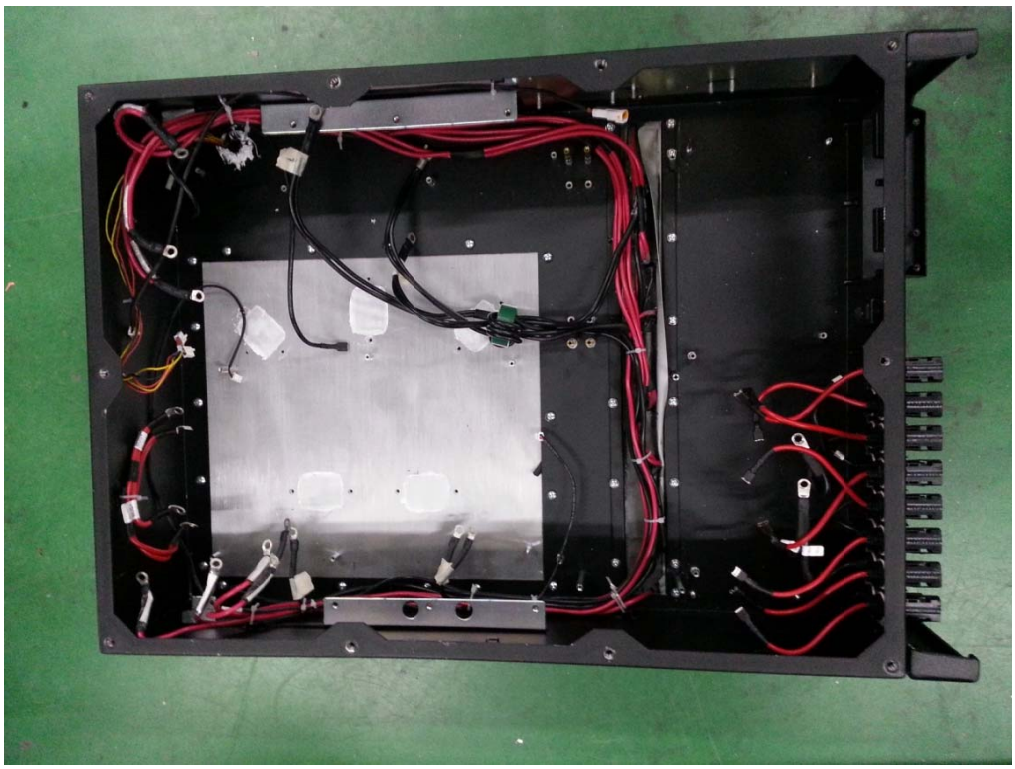
Internal view of Growatt 50000TL3-SE, Growatt 40000TL3-NSE, Growatt 33000TL3-SE, Growatt 30000TL3-SE



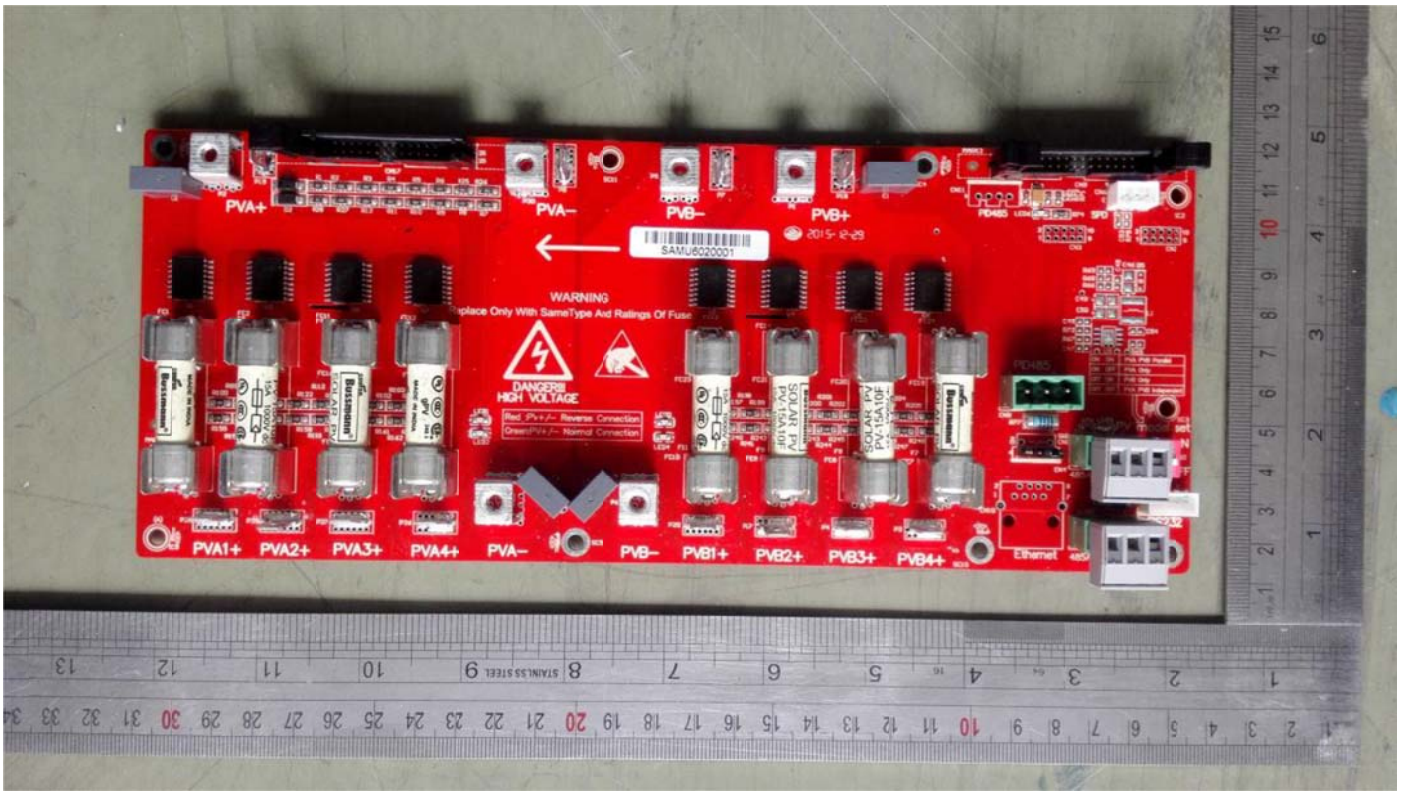
Internal view of Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S



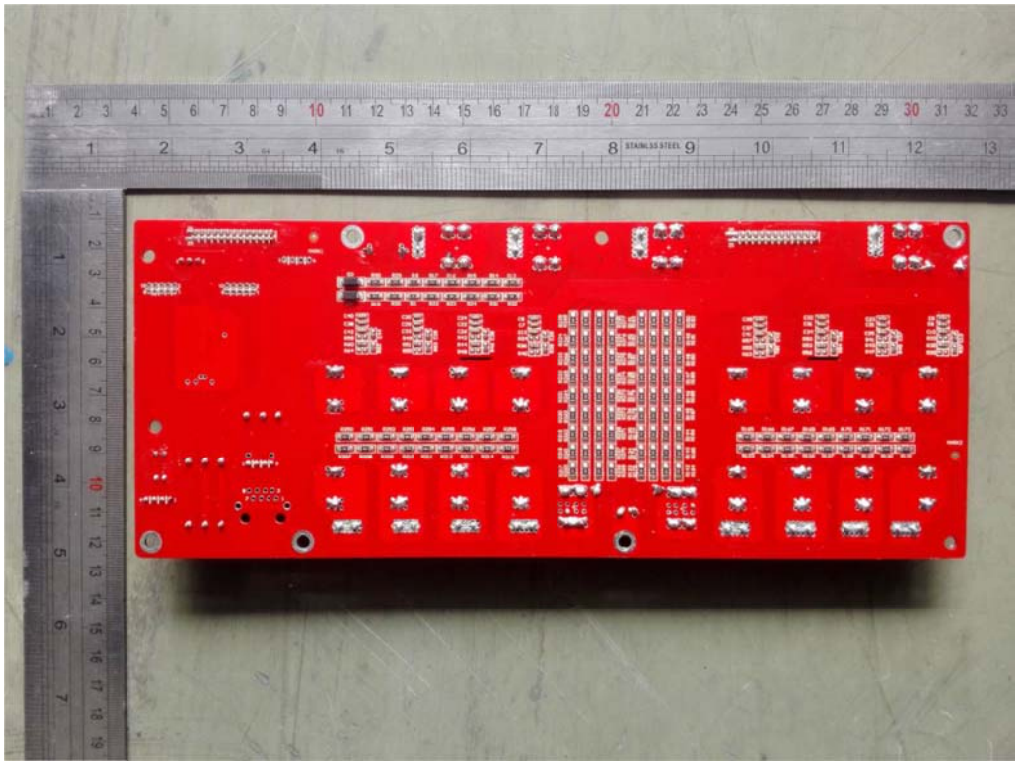
Internal view of Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S



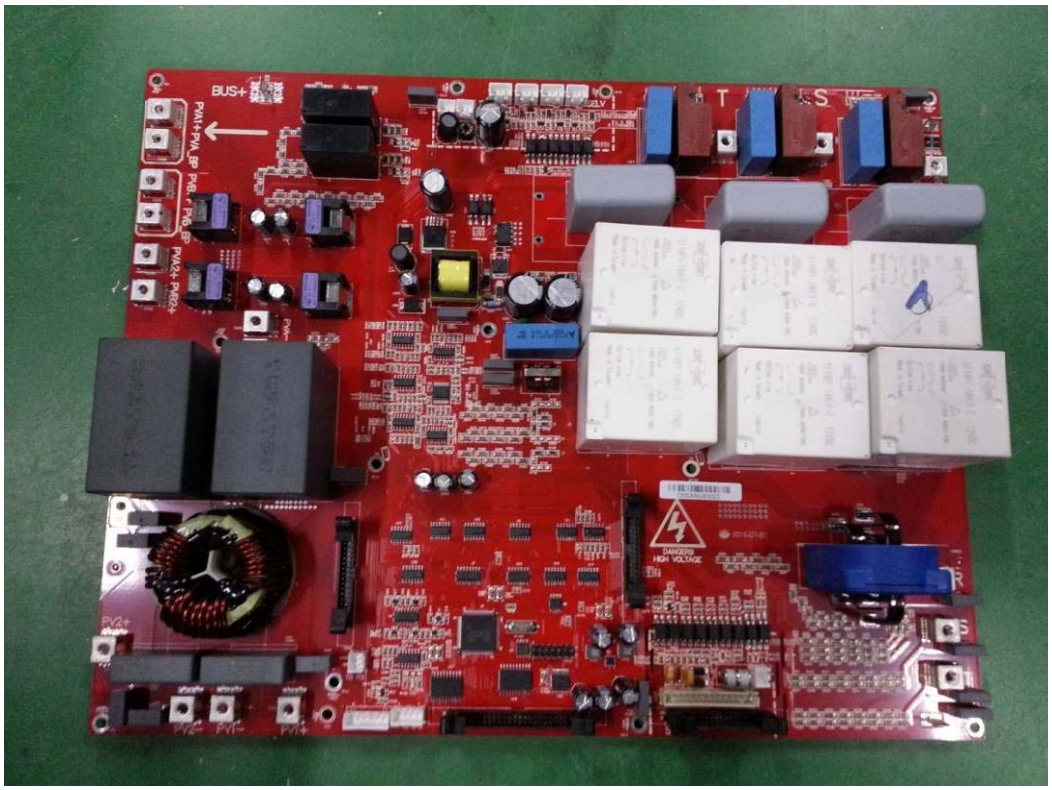
Internal view (for all models)



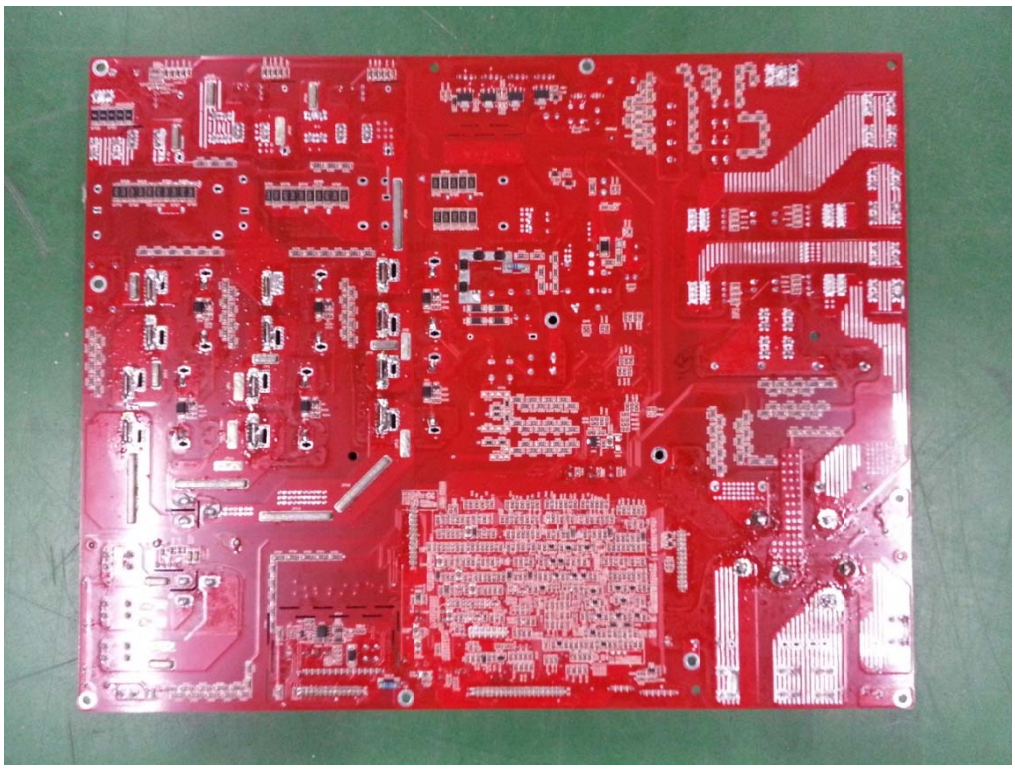
PV string monitoring board (for model Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S)



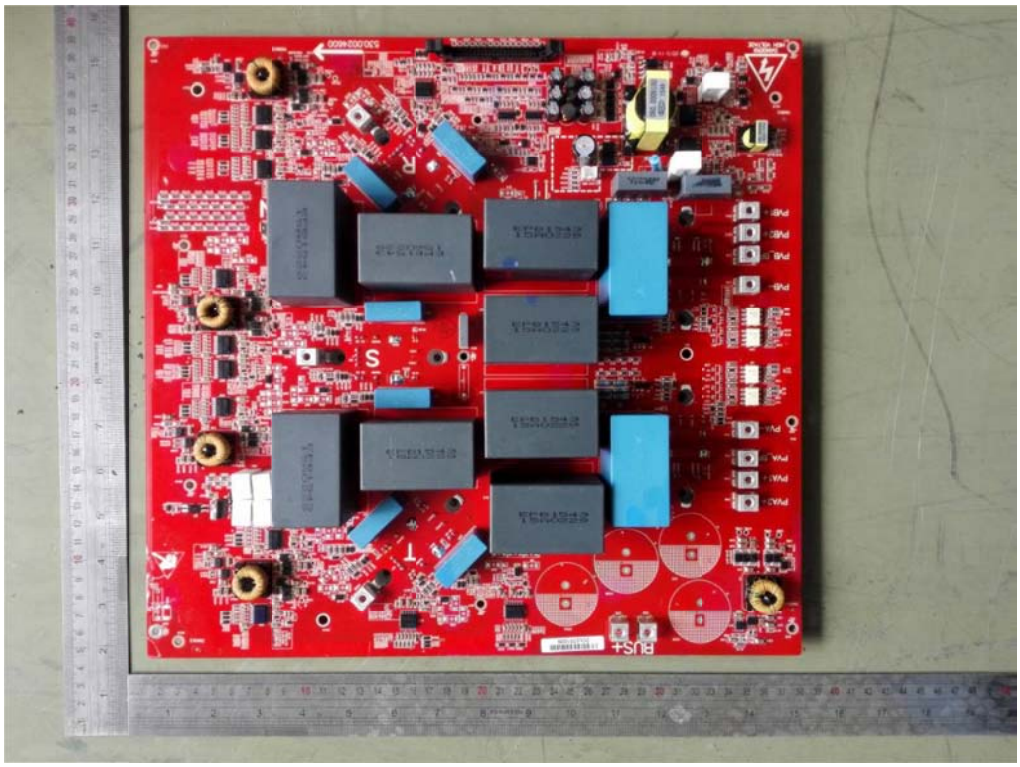
Soldering view of PV string monitoring board (for model Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S)



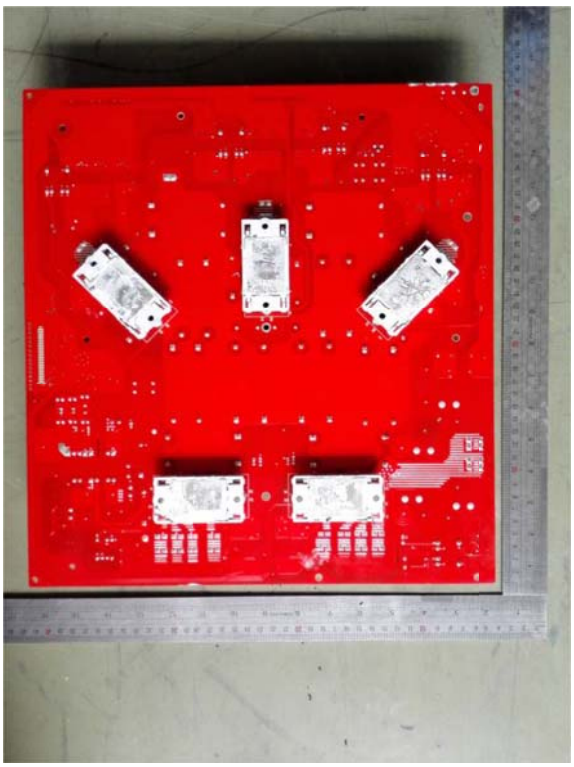
IO board view (for all models)



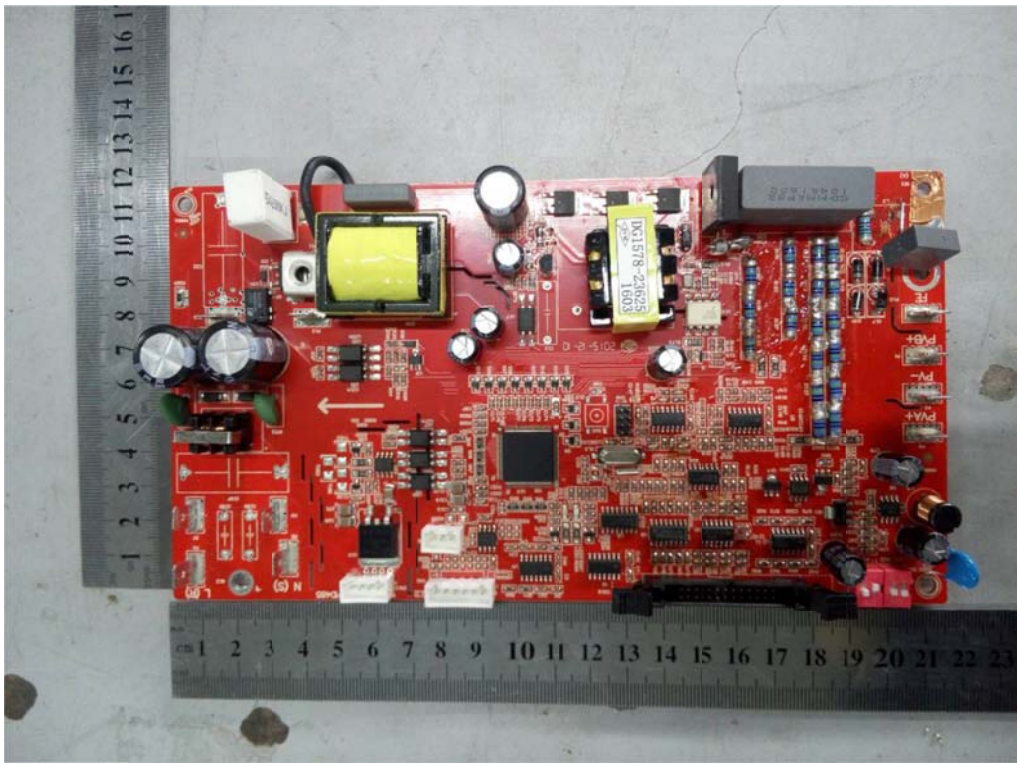
Soldering view of IO board (for all models)



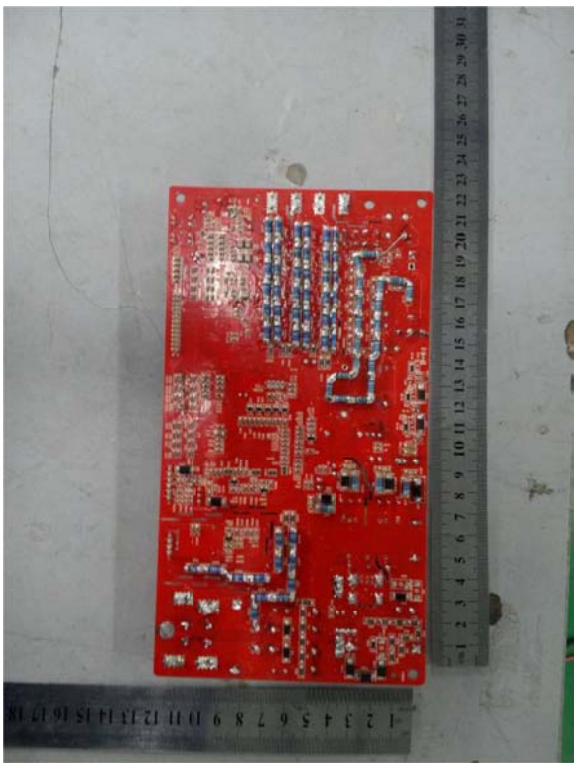
Main board view (for all models)



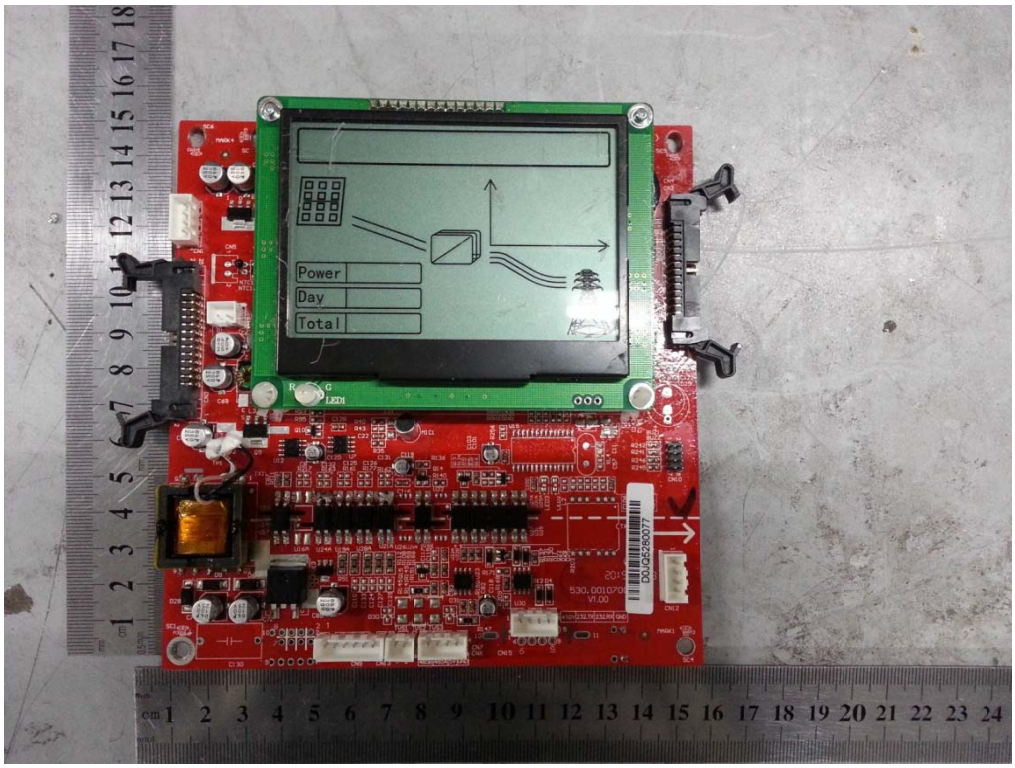
Soldering view of main board (for all models)



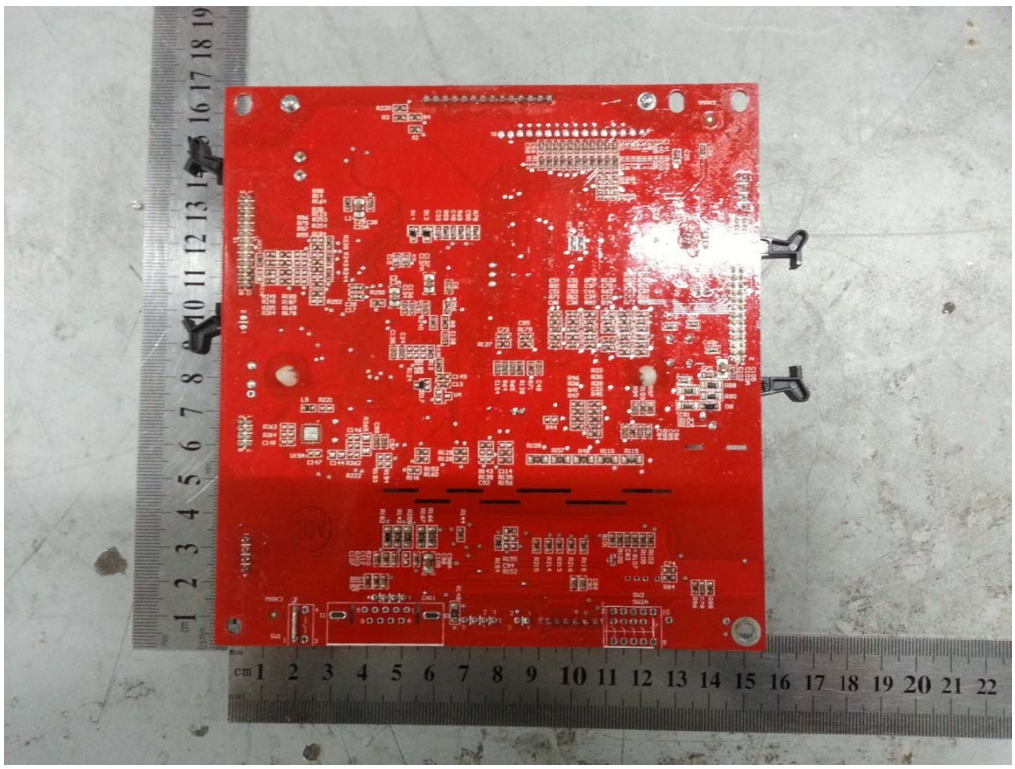
PID board view (for model Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S)



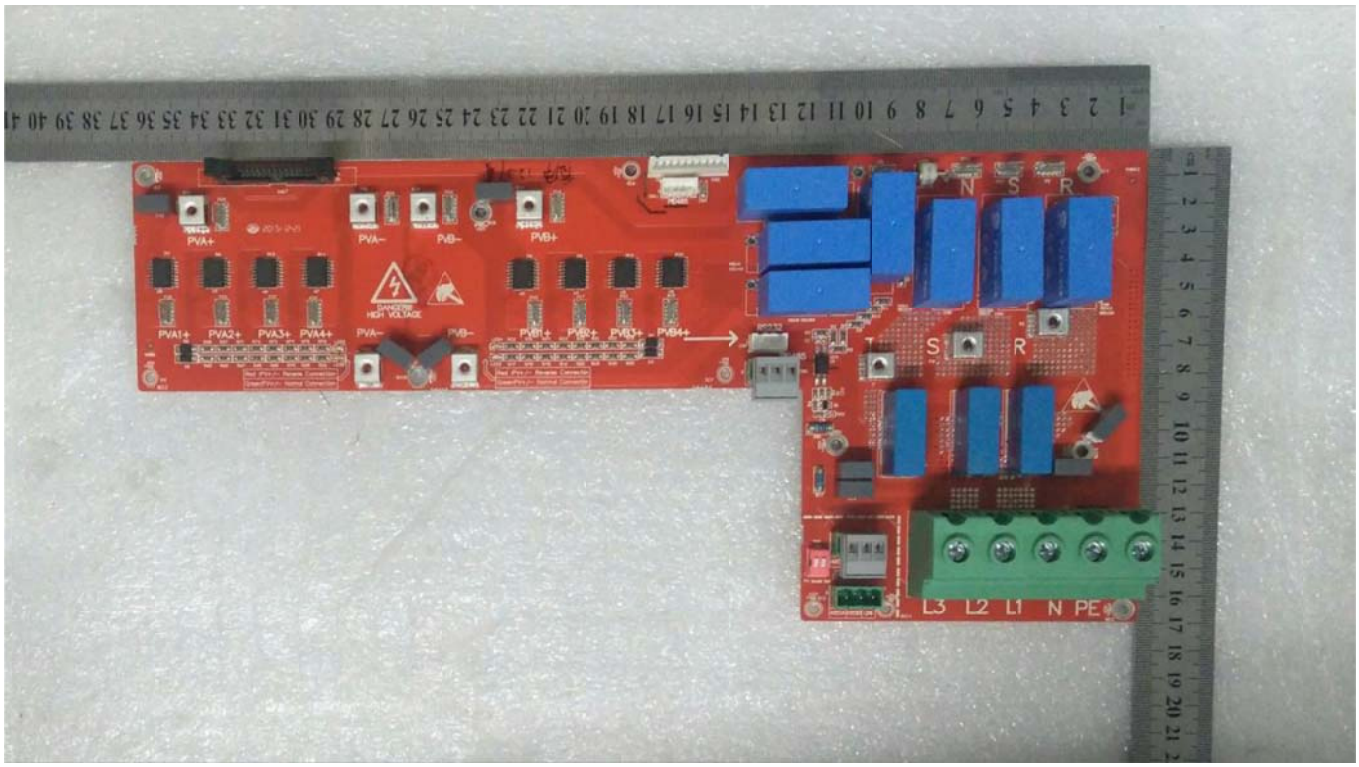
Back view of PID board (for model Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S)



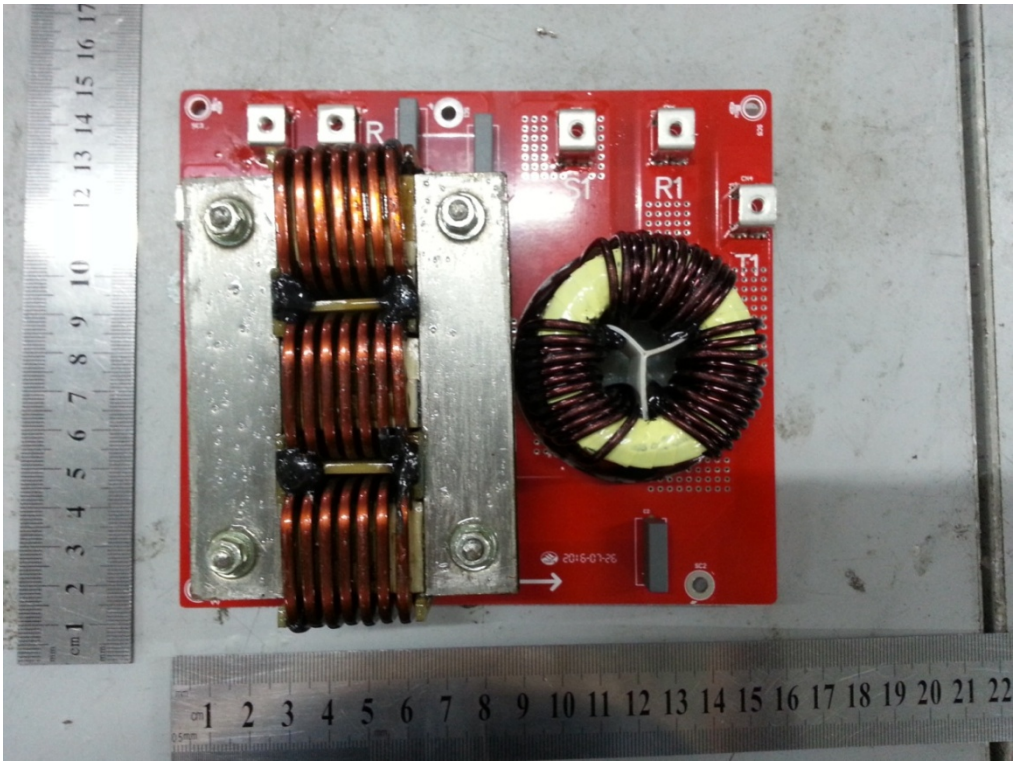
Display board view (for all models)



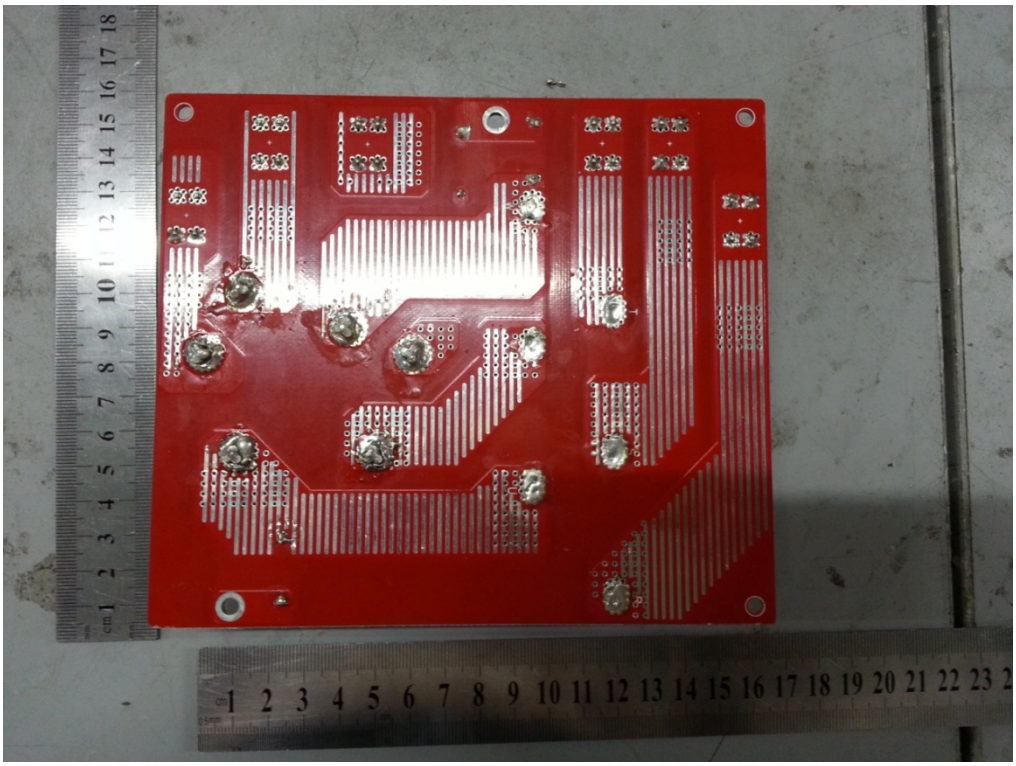
Back view of display board (for all models)



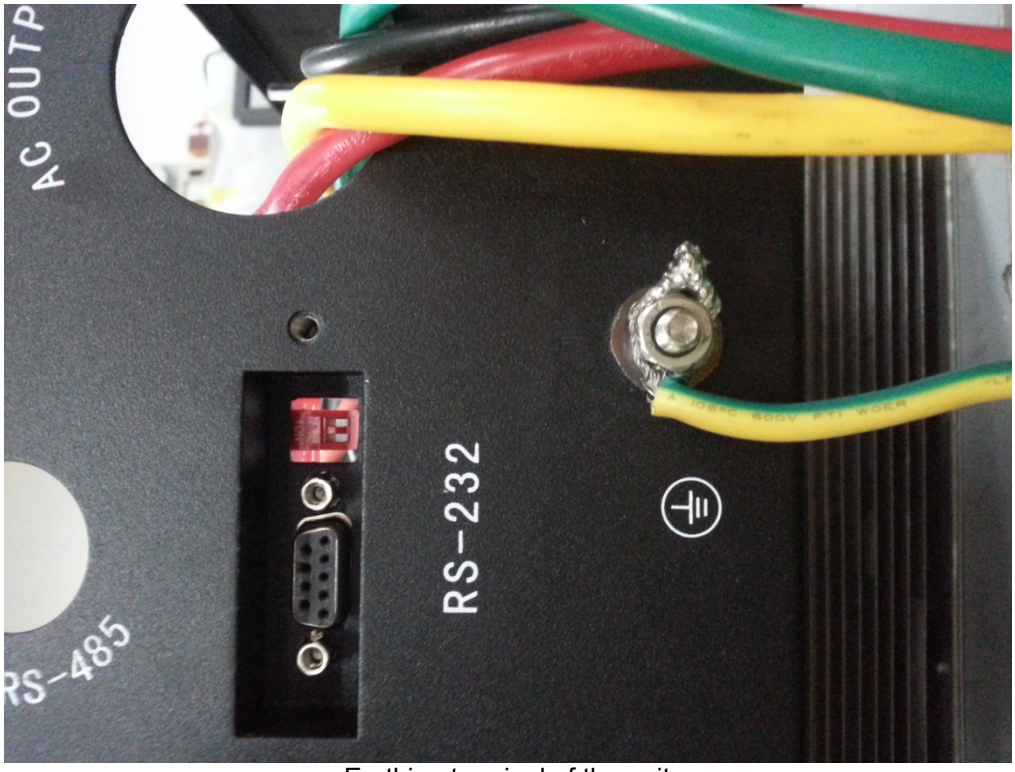
AC output board for model Growatt 50000TL3-SE, Growatt 40000TL3-NSE, Growatt 33000TL3-SE, Growatt 30000TL3-SE



LCL inductor view (for model Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S)



Soldering view of LCL inductor (for model Growatt 50000TL3-S, Growatt 40000TL3-NS, Growatt 33000TL3-S, Growatt 30000TL3-S)



Earthing terminal of the unit

----------End of report----------