



TEST REPORT
IEC 62109-1: 2010, EN 62109-1:2010
SAFETY OF POWER CONVERSION EQUIPMENT FOR USE IN
PHOTOVOLTAIC POWER SYSTEMS
PART 1 – GENERAL REQUIREMENTS

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Tested by : Georg Lang

(printed name and signature)..... :

Georg Lang

Approved by : Raphael Rader

(printed name and signature)..... :

Rader

Testing Laboratory : PRIMARA Test- und Zertifizier-GmbH

Address : Gewerbestraße 28; 87600 Kaufbeuren; Germany

Applicant's name : Studer Innotec SA

Address : Rue de Casernes 57
1950 Sion
Switzerland

Test specification:

Standard : IEC 62109-1:2010
EN 62109-1:2010

Test procedure : Verification for safety declaration

Non-standard test method : N/A

Original Test Report Form No. : IEC62109_1B

Test item description : Bidirectional Battery inverters

Manufacturer : Studer Innotec SA

Model/Type reference :

Ratings :

	XTH 3000-12	XTH 5000-24	XTH 6000-48	XTH 8000-48
Nominal battery voltage	12Vdc	24Vdc	48Vdc	48Vdc
Input voltage range	9-17Vdc	18-34Vdc	36-60Vdc	36-60Vdc
Charging current (adjustable)	0-160A	0-140A	0-100A	0-120A
Continuous Power	2500VA	4500VA	5000VA	7000VA
Output Voltage	230Vac, (150-245Vac), 50Hz			

Copy of marking plate:

"The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCB' s that own these marks"



XTH 3000-12

Pnom/P30.....2500VA / 3000VA
Battery Voltage.....12Vdc (9Vdc-17Vdc)
Idc Charge/Inv.....160Adc / 300Adc
Frequency.....50Hz (45Hz-65Hz)



Uac In.....230Vac (150Vac-265Vac)
Iac In max.....50Aac
Uac Out.....230Vac (150Vac-245Vac)
Iac Out Inv/max.....11Aac / 56Aac

SN: DXAN11321

CE IP20



Protection Class : Class I



RoHS COMPLIANT



XTH 5000-24

Pnom/P30.....4500VA / 5000VA
Battery Voltage.....24Vdc (18Vdc-34Vdc)
Idc Charge/Inv.....140Adc / 240Adc
Frequency.....50Hz (45Hz-65Hz)



Uac In.....230Vac (150Vac-265Vac)
Iac In max.....50Aac
Uac Out.....230Vac (150Vac-245Vac)
Iac Out Inv/max.....20Aac / 56Aac

SN: DXBN11322

CE IP20



Protection Class : Class I



RoHS COMPLIANT



XTH 6000-48

Pnom/P30.....5000VA / 6000VA
Battery Voltage.....48Vdc (36Vdc-60Vdc)
Idc Charge/Inv.....100Adc / 150Adc
Frequency.....50Hz (45Hz-65Hz)



Uac In.....230Vac (150Vac-265Vac)
Iac In max.....50Aac
Uac Out.....230Vac (150Vac-245Vac)
Iac Out Inv/max.....22Aac / 56Aac

SN: DXCN15790

CE IP20



Protection Class : Class I



RoHS COMPLIANT



XTH 8000-48

Pnom/P30.....7000VA / 8000VA
Battery Voltage.....48Vdc (36Vdc-60Vdc)
Idc Charge/Inv.....120Adc / 200Adc
Frequency.....50Hz (45Hz-65Hz)



Uac In.....230Vac (150Vac-265Vac)
Iac In max.....50Aac
Uac Out.....230Vac (150Vac-245Vac)
Iac Out Inv/max.....31Aac / 85Aac

SN: DXDN15791

CE IP20



Protection Class : Class I



RoHS COMPLIANT

History Sheet:

Georg Lang	2017-08-16	Initial report was written	Rev. 0
Georg Lang	2017-10-05	Editorial Changes	Rev. 1

Tests performed (name of test and test clause):

All as relevant, see relevant clause below

Testing location:

Primara Test und Zertifizier GmbH
Gewerbestraße 28
87600 Kaufbeuren

Summary of testing:

The Product was tested to the standard EN 62109-1:2010.

1. The units were tested on a 50 A (IEC) 1 poles branch circuit breaker. The safety of the unit relies on the branch circuit of building installation. The unit is approved for TN/TT mains connections.
2. DC Input to AC output is insulated by reinforced insulation. The signal input/output is insulated by reinforced insulation to hazardous voltage.
3. The input and output connections are done via screw terminals and secured by cord anchorage on the outside of the unit. Alternatively AC connection can be achieved through power cord connection with an appropriate plug-
4. The battery inverters are rated class I.
5. The power transformer IND 1 has an electrical reinforced insulation system designated Class B.
6. The equipment has been evaluated for use in a Pollution Degree II (and overvoltage category III for mains circuit and OVC II for battery circuit). Environment and a maximum altitude of 3000m according to the table F.1 in the standard IEC62109-1.
7. The enclosure fulfill the requirements of an electrical, mechanical enclosure
8. The product was evaluated for a maximum ambient of 55°C. The temperature test was performed without forced air cooling.
9. Marking: The unit needs following markings:
 - Marking according Table C.1 drawing 14 needed, Hot surfaces

General product information:

The devices are bidirectional inverters for use in photovoltaic installations which provide the following functions:

- Battery charging (12V;24V;48V dependent on model)
- Feeding into the Grid
- Use as stand-alone inverter
- AC pass through function

The battery circuit has to be protected by an external melting fuse, as stated in the manual in the positive battery voltage line. The units provide EMC filtering at the output toward mains. The units provide galvanic separation from the battery circuit to the AC-circuit. The units provide reinforced insulation between hazardous voltage and SELV:

The units provide 3 operator accessible SELV terminals to which an external control terminal can be connected.

The units are equipped with 2 AC connections and one DC bidirectional connection for battery charging and discharging. Both the AC input and AC output can be connected in multiple configurations according to the final product use. The inverter is using the battery power to generate AC power. The Smart-boost option allows feeding a load on the AC output using the energy stored in the batteries while at the same time using energy taken from the grid or a generator. The units allow parallel operation as part of a 3 phase system.

Production testing

Dielectric Testing according to 7.5.2:

AC to Earth: 2120Vdc, at least 1 sec.

AC to User: 2120Vdc, at least 1 sec.

This Test Report includes the following Appendixes:

Appendix No.	Description
1	Pictures of the unit
2	Transformer drawings
3	Test equipment list

Test item particulars	
Equipment mobility	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains	☒ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Environmental category	☐ outdoor ☐ indoor unconditional ☒ indoor conditional
Over voltage category Mains	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV	☐ OVC I ☐ OVC II ☐ OVC III ☐ OVC IV No direct connection to PV
Mains supply tolerance (%)	-90 / +110 %
Tested for power systems	TN / TT
IT testing, phase-phase voltage (V)	The stand alone provide optional IT output
Class of equipment	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg)	XTH3000-12 (34kg); XTH5000-24 (40kg); XTH6000-48 (42kg); XTH8000-48(46kg)
Pollution degree	PD2
IP protection class.....	IP20
.....	
Testing	
Date of receipt of test item(s).....	2017-05-08
Dates tests performed	2017-05-30 – 2017- 07-25
Possible test case verdicts:	
– test case does not apply to the test object	N/A
– test object does meet the requirement	Pass (P)
– test object was not evaluated for the require-ment.....	N/E
– test object does not meet the requirement	Fail (F)
General remarks:	
"(see Attachment #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report. The tests 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 testing laboratory. List of test equipment must be kept on file and available for review. Additional test data and/or information provided in the attachments to this report. Throughout this report a ☒ comma / ☐ point is used as the decimal separator.	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4	GENERAL TESTING REQUIREMENTS		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions		P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment		P
4.2.2.4	Accessories		P
4.2.2.5	Covers and removable parts		P
4.2.2.6	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	(see appended table 4.2.2.6)	P
4.2.2.7	Supply ports other than the mains		P
4.2.2.7.1	Photovoltaic supply sources a) Open circuit voltage: b) Short-circuit current:		N/A
4.2.2.7.2	Battery inputs	(see appended table 4.2.2.7)	P
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		P
4.2.2.11	Available short circuit current		P
4.3	Thermal testing	(see appended table 4.3)	P
4.3.1	General		P
4.3.2	Maximum temperatures		P
4.3.2.1	General		P
4.3.2.2	Touch temperatures		P
4.3.2.3	Temperature limits for mounting surfaces		P
4.4	Testing in single fault condition	(see appended table 4.4)	P
4.4.1	General		P
4.4.2	Test conditions and duration for testing under fault conditions		P
4.4.2.1	General		P
4.4.2.2	Duration of tests		P

4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other hazards		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	Single fault conditions to be applied		P
4.4.4.1	Component fault tests		P
4.4.4.2	Equipment or parts for short-term or intermittent operation		N/A
4.4.4.3	Motors		N/A
4.4.4.4	Transformer short circuit tests		P
4.4.4.5	Output short circuit		P
4.4.4.6	Backfeed current test for equipment with more than one source of supply	No backfeed possible, AC and DC circuit are separated through an insulation transformer in addition to a relay in series	P
4.4.4.7	Output overload		P
4.4.4.8	Cooling system failure		P
4.4.4.9	Heating devices		N/A
4.4.4.10	Safety interlock systems		N/A
4.4.4.11	Reverse d.c. connections		P
4.4.4.12	Voltage selector mismatch		N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity		P
4.4.4.14	Printed wiring board short-circuit test		N/A
4.5	Humidity preconditioning	The units are not intended for operation in wet locations.	N/A
4.5.1	General		N/A
4.5.2	Conditions		N/A
4.6	Backfeed voltage protection	Galvanic separation through transformer between DC and AC circuits in addition to a relay in series	N/A
4.6.1	Backfeed tests under normal conditions		N/A
4.6.2	Backfeed tests under single-fault conditions		N/A
4.6.3	Compliance with backfeed tests		N/A
4.7	Electrical ratings tests	(see appended table 4.2.2.6)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P
5	MARKING AND DOCUMENTATION		P
5.1	Marking		P

5.1.1	General	Marking plate and symbols are visible, symbols are documented in the manual	P
	Equipment shall bear markings as specified in 5.1 and 5.2		P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.		P
	Graphic symbols shall be explained in the documentation provided with the PCE.		P
5.1.2	Durability of markings	See table 5.1.2 below The marking was durable and legible. The label was not easily removed and did not show curling.	P
	Markings required by this clause to be located on the PCE shall remain clear and legible under conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer		P
5.1.3	Identification	see marking plate above	P
	The equipment shall, as a minimum, be permanently marked with:		P
	a) the name or trade mark of the manufacturer or supplier		P
	b) model number, name or other means to identify the equipment		P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.		P
5.1.4	Equipment ratings	see marking plate above	P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:		P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input		P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output		P
	– the ingress protection (IP) rating as in 6.3 below		P
5.1.5	Fuse identification	No internal fuses, manual states the need to connect battery only with appropriate fuses in the battery lines.	P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		N/A

	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated	Indicated in the manual	P
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.		N/A
5.1.6	Terminals, Connections, and Controls	Terminals are labelled on the PCB	P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.		P
	Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action shall be coloured red.	No emergency stop devices	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other nonpermanent material.		N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign “+” for positive and “-”, for negative; or	Marked on the enclosure	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation		N/A
5.1.6.1	Protective Conductor Terminals	Terminal is labelled on the PCB (PE)	P
	The means of connection for the protective earthing conductor shall be marked with:		P
	– symbol 7 of Annex C; or		P
	– the letters “PE”; or		N/A
	– the colour coding green-yellow.		N/A
5.1.7	Switches and circuit-breakers	No switches and circuit breakers provided	N/A
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.		N/A
5.1.8	Class II Equipment	The inverter is class I equipment	N/A

	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections		N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings	Warning mark Hot surfaces available	P
5.2.1	Visibility and legibility requirements for warning markings	Markings are clearly visible	P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high		P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depth or raised height of at least 0,5 mm.		N/A
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C		P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		N/A
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heatsinks and similar parts	No ungrounded parts	N/A
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heatsink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heatsink exists.		N/A

5.2.2.2	Hot Surfaces	Symbol for hot surface provided	P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	The temperatures measured during testing shows that the limits specified are not exceeded. Nevertheless this clause is considered as Pass	P
5.2.2.3	Coolant	No cooling system but heat sink	N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:		N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		N/A
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	See appended test table, limits are not exceeded. Warning mark not applicable	N/A
5.2.2.5	Motor guarding	No motors provided in the unit	N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).		N/A
5.2.3	Sonic hazard markings and instructions	No marking required	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply	Unit provides an adequate marking	P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.		P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		P

5.2.5	Excessive touch current		N/A
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.		N/A
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:	Instructions in the native language of the respective countries provided	P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1	Indoor conditional; see manual point 3.4	P
	– WET LOCATIONS classification for the intended external environment as per 6.1		N/A
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	PD2	P
	– INGRESS PROTECTION rating as per 6.3	IP20	P
	– Ambient temperature and relative humidity ratings		P
	– MAXIMUM altitude rating	2000m	P
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;	OVCIII	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE	No connection to PV	N/A
5.3.1.1	Language	Instructions in the native language of the respective countries provided	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.		P
5.3.1.2	Format	Printed manual is shipped with the unit	P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.		P

	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.		P
5.3.2	Information related to installation	Manual was reviewed	P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		P
	a) assembly, location, and mounting requirements:		P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and external controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P
	f) requirements for special services, for example cooling liquid;	No cooling liquid	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;		N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;		N/A
	i) tightening torque to be applied to wiring terminals;	Stated in the manual	P
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceeds the max. rated current of the circuit, as per 4.4.4.6;	No backfeed possible, transformer and relays prevent backfeed	N/A
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and	Stated in the manual	P
	l) compatibility with RCD and RCM;	Stated in the manual	P
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:	Stated in the manual	P
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:	DC circuit separated from AC circuit by an isolating transformer.	N/A

	“This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.”		N/A
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	Stated in the manual. Lead batteries, voltage dependent on model	P
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.	No connection to PV	N/A
5.3.3	Information related to operation	Manual was reviewed	P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		P
	– Instructions for adjustment of controls including the effects of adjustment;		P
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		N/A
	– Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.		P
5.3.4	Information related to maintenance	Manual was reviewed	P
	Maintenance instructions shall include the following:		P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		N/A
	– Part numbers and instructions for obtaining any required operator replaceable parts;	No operator replaceable parts. Manual states only manufacturer approved service personnel is allowed to repair the equipment.	N/A
	– Instructions for safe cleaning (if recommended)		N/A
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.	Stated in the manual	P

5.3.4.1	Battery maintenance	Manual was reviewed	P
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		P
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		P
	– When replacing batteries, replace with the same type and number of batteries or battery packs		
	– General instructions regarding removal and installation of batteries		P
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		P
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		P
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		P
	a) Remove watches, rings, or other metal objects.		P
	b) Use tools with insulated handles.		P
	c) Wear rubber gloves and boots.		P
	d) Do not lay tools or metal parts on top of batteries		P
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		P
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		P

6	ENVIRONMENTAL REQUIREMENTS AND CONDITIONS		P
	The manufacturer shall rate the PCE for the following environmental conditions:	Applied	P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below		P
	– Suitability for WET LOCATIONS or not		N/A
	– POLLUTION DEGREE rating in 6.2 below		P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below		P
	– Ultraviolet (UV) exposure rating, as in 6.4 below	Units are rated for indoor conditional	N/A
	– Ambient temperature and relative humidity ratings, as in 6.5 below		P

6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor	The unit is not intended for outdoor use	N/A
6.1.2	Indoor, unconditioned	The unit is not intended for indoor, unconditioned use	N/A
6.1.3	Indoor, conditioned	The unit is intended for indoor, conditioned use	P
6.2	Pollution degree	Pollution degree II was applied	P
6.3	Ingress Protection	The unit is rated IPXX, see annex no. 2	P
6.4	UV exposure	Equipment for indoor use	N/A
6.5	Temperature and humidity	-20°C...+55°C Max. 95% rel. humidity, non-condensing.	P

7	PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS		P
7.1	General		P
7.2	Fault conditions	Noticed, see also table 4.4 below	P
7.3	Protection against electric shock		P
7.3.1	General		P
7.3.2	Decisive voltage classification	See table 7.3.2 below	P
7.3.2.1	Use of decisive voltage class (DVC)	Input and output circuits are considered as DVC C. Communication circuits are considered as DVC A	P
7.3.2.2	Limits of DVC (according table 6)		P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)		P
7.3.2.5	Connection to PELV and SELV circuits		P
7.3.2.6	Working voltage and DVC		P
7.3.2.6.1	General		P
7.3.2.6.2	AC working voltage (see Figure 2)		P
7.3.2.6.3	DC working voltage (see Figure 3)		P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		N/A
7.3.3	protective separation	Protective separation achieved by reinforced insulation	P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or		P
	▪ protective screening, i.e. by a conductive screen connected to earth by protective bonding in the PCE, or connected to the protective earth conductor itself, whereby the screen is separated from live parts by at least basic insulation, or		N/A

	protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or		P
	limitation of voltage according to 7.3.5.4.		P
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact		P
7.3.4.1	General	Applied	P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).		P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.	No such device	N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers		P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General	Enclosure not removable without the use of a tool	P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).		P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6	Already approved plastic materials used, see list of critical components	P
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts		P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts		N/A
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,		N/A

7.3.4.2.3	Access probe tests	No live parts accessible	P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and		P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuse-holders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavourable position.		P
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.		N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.		P
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction $\pm 5^\circ$ only.		P
7.3.4.2.4	Service access areas	During installation and maintenance the unit is not energized	N/A
7.3.4.3	Protection by means of insulation of live parts	7.3.4.2 was applied	N/A
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		N/A
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		N/A
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note “†” under Table 7)		N/A
7.3.5	Protection in case of direct contact		P
7.3.5.1	General		P

	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or		P
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with protective separation. This applies for example to plug-in-sub-assemblies or other plug-in devices which can be plugged-in without the use of a tool (key) or which are accessible without the use of a tool.	No live parts accessible. Enclosure is not removable without the use of a tool.	N/A
	Conformity is checked by visual inspection and trial insertion.		N/A
7.3.5.2	Protection using decisive voltage class A	See table 7.3.5.2 below	P
7.3.5.3	Protection by means of protective impedance		P
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		P
7.3.5.3.1	Limitation of current through protective impedance	See table 7.3.5.3.1 below	P
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		P
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A
7.3.5.4	Protection by means of limited voltages	See table 7.3.5.4 below	P
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		P

	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		P
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact	Protection is given through protective bonding which is separated from hazardous voltage by basic insulation	P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)		P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I		P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.		N/A
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.		N/A
7.3.6.2	Insulation between live parts and accessible conductive parts		P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5		P
7.3.6.3	Protective class I – Protective bonding and earthing		P
7.3.6.3.1	General		P
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:		P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or		N/A
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.		P

7.3.6.3.2	Requirements for protective bonding	Impedance test of 7.3.6.3.3 was applied	P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;		P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		N/A
	c) through a dedicated protective bonding conductor;		P
	d) through other metallic components of the PCE		P
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.		N/A
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.	No such connections used	N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.	No such connections used	N/A
7.3.6.3.3	Rating of protective bonding	see table 7.3.6.3.3 below	P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.		P
	As alternative to a) and b) the protective bonding may be designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.		N/A

	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:	See table 7.3.6.3.3 below	P
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		P
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.		P
	On equipment where the protective earth connection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cable is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		N/A
7.3.6.3.3.1	Test current, duration, and acceptance criteria		P
	The test current, duration of the test and acceptance criteria are as follows:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω .		N/A

	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		P
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		P
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		P
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)		N/A
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:	Bonding is provided by bonding connection at the AC terminal and an additional screw terminal at the enclosure	N/A
	the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:		N/A
	the test duration may be reduced to no less than 2 s		N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor		P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.		P

	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		N/A
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	▪ 2,5 mm ² if mechanical protection is provided;		P
	▪ 4 mm ² if mechanical protection is not provided.		N/A
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.	External earthing conductor directly screwed to the enclosure	N/A
7.3.6.3.6	Means of connection for the external protective earthing conductor	Screw connection	P
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		N/A
	Marking shall not be done on easily changeable parts such as screws.		P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.		N/A

	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	Touch current below limit values, see appended test table	P
	a) Permanently connected wiring, and:		N/A
	a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or		N/A
	automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		N/A
	provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm ² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Units are rated Class I	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		N/A

	equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage, protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment;		N/A
	metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	equipment employing protective class II shall be marked according to 5.1.8.		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	pollution degree	PD2	P
	overvoltage category	OVCIII	P
	supply earthing system	TN / TT	P
	insulation voltage	4000V	P
	location of insulation	See block diagram	P
	type of insulation	Basic insulation between live parts at hazardous voltage and ground. Reinforced insulation between hazardous voltage and SELV circuits.	P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.		P
7.3.7.1.3	Supply earthing systems		P

	Three basic types of earthing system are described in IEC 60364-1. They are:		P
	TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P
	TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		P
	IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		N/A
7.3.7.1.4	Insulation voltages	See table 7.3.7.5 below	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstand voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General	See table 7.3.7 below	P
7.3.7.2.2	Circuits connected directly to the mains		P
7.3.7.2.3	Circuits other than mains circuits		P
7.3.7.2.4	Insulation between circuits		P
7.3.7.3	Functional insulation		P
7.3.7.4	Clearance distances	See table 7.3.7 below	P
7.3.7.4.1	Determination		P
7.3.7.4.2	Electric field homogeneity		N/A
7.3.7.4.3	Clearance to conductive enclosures		P
7.3.7.5	Creepage distances	See table 7.3.7 below	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage		P
7.3.7.5.3	Materials	Material IIIb was considered	P
7.3.7.6	Coating		N/A
7.3.7.7	PWB spacings for functional insulating		N/A
7.3.7.8	Solid insulating		P
7.3.7.8	Solid insulation		P
7.3.7.8.1	General	See table 7.3.7 below	P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation	Already approved materials used for insulation see list of critical components	P

7.3.7.8.2.1	Basic, supplemental, reinforced, and double insulation		P
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm		N/A
7.3.7.8.3.3	Material thickness less than 0,2 mm	Transformer foil thickness 0,5mm	P
7.3.7.8.3.4	Compliance		P
7.3.7.8.4	Printed wiring boards		P
7.3.7.8.4.1	General		P
7.3.7.8.4.2	Use of coating materials	No coating materials	N/A
7.3.7.8.5	Wound components		P
7.3.7.8.6	Potting materials		N/A
	A potting material may be used to provide solid insulation or to act as a coating to protect against pollution	Potting not used for those purposes	N/A
7.3.7.9	Insulation requirements above 30 kHz	No Insulation requirements above 30 kHz	N/A
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility	The unit with separate on transformer does not provide a RCD External RCD Type D capability, described in the manual	P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.		N/A
7.3.9	Capacitor discharge		P
7.3.9.1	Operator access area	See table 7.3.9 below	P
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.		P
7.3.9.2	Service access areas		N/A
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE.		N/A
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level	See table 7.4 below	P

	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5 CU^2$		N/A
7.4.2	Operator Access Areas		P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.		P
7.4.3	Services Access Areas		P
7.5	Electrical tests related to shock hazard		P
7.5.1	Impulse voltage test (type test)		N/A
7.5.2	Voltage test (dielectric strength test)	See table 7.5.2 below	N/A
7.5.2.1	Purpose of test		P
7.5.2.2	Value and type of test voltage	See table 7.5.2 below	P
7.5.2.3	Humidity pre-conditioning	Unit is not intended to be used in wet locations	N/A
7.5.2.4	Performing the voltage test		P
7.5.2.5	Duration of the a.c. or d.c. voltage test		P
7.5.2.6	Verification of the a.c. or d.c. voltage test		P
7.5.3	Partial discharge test	Not required, Vp is smaller than 700 V and voltage stress is smaller 1kV/mm	N/A
7.5.4	Touch current measurement (type test)	See table 7.5.4 below	P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	No excessive touch current	N/A
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		N/A
7.5.5	Equipment with multiple sources of supply	Information provided	P

8	PROTECTION AGAINST MECHANICAL HAZARDS		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.	No sharp edges	P

	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		N/A
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.	No moving parts provided	N/A
8.2.1	Protection of service persons		N/A
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.		N/A
8.3	Stability		P
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	see table 8.3 below	P
8.4	Provisions for lifting and carrying		
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.	Mass of equipment more than 18kg, means for lifting and carrying in the manual	P
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.		P
8.5	Wall mounting		P
	Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.	See table 8.5 below	
8.6	Expelled parts		P
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.	No expelled parts	P

9	PROTECTION AGAINST FIRE HAZARDS		P
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.	Only approved components are used.	P
9.1.1	Reducing the risk of ignition and spread of flame	Method 1 applied	P

	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.	Method 1 was applied	P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.		P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		N/A
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		N/A
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and		N/A
	– insulated wiring, except as permitted in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure		N/A
9.1.3	Materials requirements for protection against fire hazard		
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures		P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.	Metal enclosure is used	P

9.1.3.3	Materials for components and other parts outside fire enclosures		N/A
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.		N/A
9.1.3.4	Materials for components and other parts inside fire enclosures		P
9.1.3.5	Materials for air filter assemblies	No air filter	N/A
9.1.4	Openings in fire enclosures		P
9.1.4.1	General		P
	For equipment that is intended to be used or installed in more than one orientation as specified in the product documentation, the following requirements apply in each orientation.	Not intended to be installed in more than one orientation	N/A
	These requirements are in addition to those in the following sections:		P
	– 7.3.4, Protection against direct contact;		P
	– 7.4, Protection against energy hazards;		P
	– 13.5, Openings in enclosures		P
9.1.4.2	Side openings treated as bottom openings	No side openings	N/A
9.1.4.3	Openings in the bottom of a fire enclosure		P
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.	Openings in the bottom of the enclosure fulfill the requirements mentioned in table 21 of the standard	P
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA	Equipment not intended to be used in closed electrical operating areas	N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		N/A
9.1.4.6	Additional requirements for openings in transportable equipment	Fixed equipment	N/A
9.2	LIMITED POWER SOURCES	see table 9.2 below	N/A
9.2.1	General		N/A
9.2.2	Limited power source tests		N/A
9.3	Short-circuit and overcurrent protection		P

9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.		P
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.		P

10	PROTECTION AGAINST SONIC PRESSURE HAZARDS		P
10.1	General		P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.		P
10.2	Sonic pressure and Sound level	see table 10 below	P
10.2.1	Hazardous Noise Levels	No Hazardous Noise Level	N/A

11	PROTECTION AGAINST LIQUID HAZARDS		N/A
11.1	Liquid Containment, Pressure and Leakage	No liquid	N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease		N/A

12	CHEMICAL HAZARDS	No chemicals	N/A
12.1	General		N/A

13	PHYSICAL REQUIREMENTS		P
13.1	Handles and manual controls	see table 13.1 below	P
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.	No handles, knobs, grips, levers and the like installed	P
13.1.1	Adjustable controls	Done by the manufacturer via software	P
13.2	Securing of parts		P
13.3	Provisions for external connections		P
13.3.1	General		P
13.3.2	Connection to an a.c. Mains supply		P
13.3.2.1	General		P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:		P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		P
	– a non-detachable power supply cord for connection to the supply by means of a plug		N/A
	– an appliance inlet for connection of a detachable power supply cord; or		N/A
	– a mains plug that is part of direct plug-in equipment as in 13.3.8		N/A
13.3.2.2	Permanently connected equipment		N/A
13.3.2.3	Appliance inlets	No Appliance inlets	N/A
13.3.2.4	Power supply cord	No power supply cord shipped. Installer is responsible for wiring. The minimum wire sizes for the installation are stated in the manual.	N/A
13.3.2.5	Cord anchorages and strain relief	Units are supplied with wiring terminals	N/A
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A

	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors		P
13.3.3.1	Wiring terminals		P
13.3.3.2	Screw terminals		P
13.3.3.3	Wiring terminal sizes		P
13.3.3.4	Wiring terminal design	AC connector is already approved. Already approved terminals used-	P
13.3.3.5	Grouping of wiring terminals		P
13.3.3.6	Stranded wire		P
13.3.4	Supply wiring space		P
13.3.5	Wire bending space for wires 10 mm ² and greater		P
13.3.6	Disconnection from supply sources	AC protection devices are required to be installed in the installation. A separated DC switch (see manual) allows disconnection during operation.	P
13.3.7	Connectors, plugs and sockets	Visual inspection	P
13.3.8	Direct plug-in equipment	No direct plug-in equipment	N/A
13.4	Internal wiring and connections		P
13.4.1	General		P
13.4.2	Routing	All wires routed away from sharp edges	P
13.4.3	Colour coding	Colour coding according to the standard	P
13.4.4	Splices and connections	No such splices or connections	N/A
13.4.5	Interconnections between parts of the PCE	PCE provides only one enclosure	N/A
13.5	Openings in enclosures		P
13.5.1	Top and side openings		N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.	Only bottom openings	N/A
13.6	Polymeric Materials		P
13.6.1	General		P
13.6.1.1	Thermal index or capability	Already approved plastic materials used, see list of critical components	P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards	Metal enclosure	N/A

13.6.2.1	Stress relief test		N/A
13.6.3	Polymers serving as solid insulation	Transformer insulation foil, already approved, see list of critical components	P
13.6.3.1	Resistance to arcing		
13.6.4	UV resistance		N/A
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation	Units are not intended for outdoor-use	N/A
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General		N/A
13.7.2	250-N deflection test for metal enclosures	see table 13.7.2 below	P
13.7.3	7-J impact test for polymeric enclosures		N/A
13.7.4	Drop test	Fixed unit	N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal	The enclosure has adequate minimum thickness	P

14	COMPONENTS		P
14.1	General		P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:	Components and materials have adequate flammability classification See list of critical components	P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		N/A
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P

	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Over temperature Protection		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperature HAZARD, or a fire HAZARD, shall be protected by an over temperature or thermal protection device meeting the requirements of 14.3.		N/A
14.3	Overtemperature protection devices		P
14.4	Fuse holders	Fuses are not intended to be accessible for the operator	N/A
14.5	MAINS voltage selecting devices		N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.		P
	This requirement does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		N/A
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		N/A
14.7	Circuits or components used as transient overvoltage limiting devices		P
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	Already approved varistors used, see list of critical components	N/A
14.8	Batteries		P
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	Approved button cell used	N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A

	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A non-metallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard	No reverse battery connection possible	N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions		N/A

[illegible]

4.2.2.7	TABLE: electrical data Input side (Battery Charging)						P
Type	U batt (DC) (V)	I batt (DC) (A)	U AC in (V)	I _{Ac} in (A)	P AC (kW)		
XTH 3000-12							
AC In (Bat- tery Charge)	12,0V	142,5	230,0	9,5	2,2	P	
XTH 5000-24							
AC In (Bat- tery Charge)	24,0V	139	230,0	16,6	3,8	P	
XTH 6000-48							
AC In (Bat- tery Charge)	48,0V	99	230,0	22,3	5,1	P	
XTH 8000-48							
AC In (Bat- tery Charge)	48,0V	120,4	230,0	30,5	7,0	P	

Supplementary information:
Power was measured on AC In during battery charge mode with max. charging current at nominal Battery voltage

4.3	TABLE: heating temperature rise measurements				P	
	test voltage (V)		230V	—		
	t1 (°C)		28,2°C	—		
	t2 (°C)		55°C	—		
Thermocouple Locations		Max. temperature measured (°C)		Max. temperature limit, (°C)		
Main transformer		102,7		110		
Main transformer		92,1		110		
Main transformer		90,8		110		
Auxiliary transformer		70,0		90		
Coil to CN8		65,0		110		
PCB near bridge transistor		80,5		105		
AC in terminal		69,6		105		
VR4		64,2		85		
C11		67,7		125		
SENS1		64,8		110		
K5		68,6		90		
IND1		94,5		110		
C55		72,0		100		
PCB		71,9		105		
K1		63,9		90		
Wiring to B15/B16		63,0		110		
AC out Terminal		78,3		90		
Enclosure (Mounting surface)		59,6		70		
Supplementary information: Battery charge: 48Vdc, 120Adc, 230Vac, 30Aac						
	TABLE: Heating test, resistance method				N/A	
	Test voltage (V)..... :			—		
	Ambient, t ₁ (°C)			—		
	Ambient, t ₂ (°C)			—		
Temperature rise of winding		R ₁ (Ω)	R ₂ (Ω)	ΔT (K)	Max. dT (K)	Insulation class
Supplementary information:						

4.3	TABLE: heating temperature rise measurements				P	
	test voltage (V)		230V		—	
	t1 (°C).....		32,7°C		—	
	t2 (°C)		55°C		—	
Thermocouple Locations		Max. temperature measured (°C)		Max. temperature limit, (°C)		
Main transformer		103,6		110		
Main transformer		91,3		110		
Main transformer		92,0		110		
Auxiliary transformer		72,3		90		
Coil to CN8		67,2		110		
PCB near bridge transistor		83,4		105		
AC in terminal		66,9		105		
VR4		66,4		85		
C11		65,6		125		
SENS1		64,7		110		
K5		67,4		90		
IND1		98,7		110		
C55		74,2		100		
PCB		74,5		105		
K1		65,9		90		
Wiring to B15/B16		65,6		110		
AC out Terminal		81,5		90		
Enclosure (Mounting surface)		61,2		70		
Supplementary information: Test performed on model XTH-48-8000 due to highest power intake Battery discharge 48Vdc, 160Adc, 230Vac, 31Aac						
	TABLE: Heating test, resistance method				N/A	
	Test voltage (V)				—	
	Ambient, t ₁ (°C)				—	
	Ambient, t ₂ (°C)				—	
Temperature rise of winding		R ₁ (Ω)	R ₂ (Ω)	ΔT (K)	Max. dT (K)	Insulation class
Supplementary information:						

4.4	TABLE: fault condition tests		
	ambient temperature (°C)	21,5	—
	model/type of power supply	Top Con TC.GSSS	—
	manufacturer of power supply	Regatron	—
	rated markings of power supply	Input: 20kW; Output 0-65Vdc; max. 385A	—

Component No.	Fault	Test condition (V)		Test time	Circ. brk. No. (AC)	Fault condition		Result
		DC	AC			DC	AC	
Bypass Test								
AC Input Line and Neutral re-lays	Forced short during UPS mode	48	230	1 h	--	48	230	The mandatory DC fuse opened immediately, no hazard occurred.
4.4.4.1 Component fault tests								
XTH-PCBMB1610M								
C11	Short	48	230	1 h	--	48	230	The mandatory circuit breaker at the AC input opened immediately. Isc: 50Aac
Sens1	Short	48	230	1 h	--	48	230	Unit runs normally. No hazard occurred.
Sens3	Short	48	230	1 h	--	48	230	Unit runs normally. No hazard occurred.
DZ2	Short	48	230	1 h	--	48	230	The unit shut-down immediately. No hazard occurred.
XTH-PCBDSP1210G								
U1	Supply Voltage short to GND	48	230	1s	--	48	230	Unit shut-down immediately. No hazard occurred.
C14	short	48	230	1s	--	48	230	Unit shut-down immediately. No hazard occurred.
XTH-PCB-pow910E								
MB5	Short Drain-Source	48	230	1s	--	48	230	The unit stops immediately and is defect. No restart. The bridge is defect. Dielectric strength testing was passed after fault testing.
MB5	Short Drain-Gate	48	230	1s	--	48	230	The unit stops immediately and is defect. No restart. The bridge is defect. Dielectric strength testing was passed after fault testing.
DC-Link Bulk capacitor	Short	48	230	1s	--	48	230	The unit shut-down immediately. No hazard occurred.

Component No.	Fault	Test condition (V)		Test time	Circ. brk. No. (AC)	Fault condition		Result
		DC	AC			DC	AC	
4.4.4.4 Transformer short circuit tests								
Main transformer	Short	48	230	1 h	--	48	230	Islanding mode: The unit gave out short-circuit and current and shut-off. The unit tried to restart after the short-circuit for 3times. After the 3rd restart attempt the inverter shut-down completely and a manual restart was necessary. $I_{sc}=50A_{ac}$ AC input source connected: The unit gave out short-circuit current, disconnected from the AC input source and shut-off. The unit tried to restart after the short-circuit for 3times. After the 3rd restart attempt the inverter shut-down completely and a manual restart was necessary
4.4.4.5 Output short circuit								

[illegible]

Supplementary information:

4.7	TABLE: Electrical rating tests						P	
Condition			Input voltage (VDC)	Input current (ADC)	Input power (kW)	Output voltage (Vac)	Output current (Aac)	Output power (kW)
Refer to tables 4.2.2.6 / 4.2.2.7								
Note:								

5.1.2	TABLE: Durability of markings					P
Marking required by this standard shall be durable and legible. In considering the durability of the marking, the effect of normal use shall be taken in account.						
Test procedure: - 15s with water, and then - 15s with petroleum spirit						
Use of Marking	Nameplate/electrical ratings		Warning markings			
Material	Polyester				Polyester	
Held by	Glue		Glue	Glue		
Applied Surface Material	Metal		Metal	Plastic		
OBSERVATIONS:	Name plate		Warning markings			
	Water	Hexane	Water	Hexane	Water	Hexane
Any Damage?	No		No			
Legible?	Yes		Yes			
Curled?	No		No			
Edge Lifted?	No		No			
Comments: The marking was durable and legible. The label was not easily removed and did not show curling.						

7.3.2	TABLE: Decisive voltage classification			P
From	To	RMS voltage	Peak voltage	
Main transformer of XTH 8000-48 (reinforced)				
Primary	Secondary	278	393,2	
Main transformer of XTH 6000-48 (reinforced)				
Primary	Secondary	278	393,2	
Main transformer of XTH 5000-24 (reinforced)				
Primary	Secondary	254	359,2	
Main transformer of XTH 3000-12 (reinforced)				
Primary	Secondary	242	342,2	
Comment: Test condition: Input 48/24/12Vdc, Output 230Vac @ 100% outputpower.				

7.3.5.2	TABLE: Protection using decisive voltage class A			P
<i>The unit was connected to 48Vdc and 230Vac. The output was loaded to the rated value. The voltage at each secondary winding was recorded. If the voltage exceeded 25Vac,rms or 35,4Vac,pk or 60Vdc, the measurement were taken again after the next component in series with the secondary until the voltage measured was less 25Vac or 35,4Vac,pk or 60 Vdc.</i>				
Transformer Designation	Location	Maximum Voltage (Vpk/rms)	Voltage Limiting Component	
Main Transformer 48V models.	Positive to Negative	61,0Vpk/35,2Vrms	FETs after transformer; see single fault conditons	
Comment:				
<i>Compliance is checked by re-measuring the decisive voltage.</i>				

7.3.5.3.1	TABLE: Limitation of current through protective impedance			P
The unit was connected to 48Vdc and 230Vac. The circuit of IEC 60990, Figure 4 is connected between the accessible parts and PE. The limiting value is 3,5mAac. or 10 mAdc				
From	To	Measured voltage	Calculated current	
PCB MB1610M R59	PCB MB1610M R79	57,5mV	0,12mA	
PCB MB1610M R59	PCB MB1610M R79 (R59 short-circuited)	105,6mV	0,21mA	
Comment:				
Model XTH-8000-48 was tested				

7.3.5.3.2	TABLE: Limitation of discharging energy through protective impedance			N/A
The unit was connected to xxxVdc and xxxVac. The output was loaded to the rated value.				
Relevant circuit	Measured voltage	Measured Capacitance	Values according table 7-4	
Comment: The discharging energy available between simultaneously accessible parts protected by PROTECTIVE IMPEDANCE shall not exceed the charging voltage and capacitance limits given in Table 7-4, which applies to wet and dry locations. Refer to Figure 7-8. Compliance is checked by performing calculations and/or measurements to determine the charge or the voltage and capacitance.				

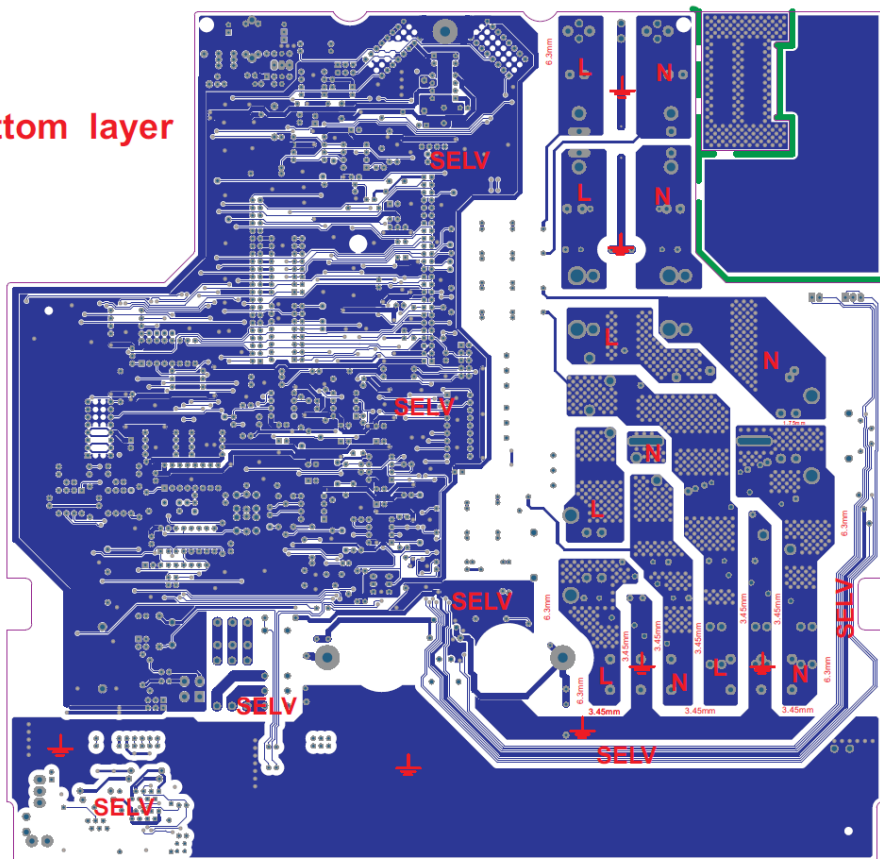
7.3.5.4	TABLE: Protection by means of limited voltages	N/A
<i>The unit was connected to xxxVdc and xxxVac. The output were loaded to the rated value. The voltage at each secondary winding was recorded.</i>		
Relevant circuit		Calculation:
Comment:		

7.3.6.3.3	TABLE: Rating of protective bonding			P
Compliance is checked by measuring the resistance of protective bonding with a current equal to the corresponding overcurrent protection value or the maximum shortcircuit current from other grounded circuits, whichever is higher.				
Accessible conductive part		Test Current in Adc	Measured Voltage in (V)	Calculated Resistance (Ω)
XTH-8000-48				
Main protective earth terminal to enclosure earthed metal part		100	0,27	2,7mΩ
XTH-6000-48				
Main protective earth terminal to enclosure earthed metal part		100	0,26V	2,6mΩ
XTH-5000-24				
Main protective earth terminal to enclosure earthed metal part		100	0,27V	2,7mΩ
XTH-3000-12				
Main protective earth terminal to enclosure earthed metal part		100	0,28V	2,8mΩ
Comments:				

7.3.7	TABLE: clearance and creepage distance measurements						P
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required cr (mm)	dcr (mm)	
Clearances and Creepage between mains-circuits and their environment (Overvoltage category III)							
	PCB						
AC to earth (basic)	325	230	3,4	3,4	3,4	3,4	
AC to DC/User (reinforced)	325	230	6,3	6,3	6,3	6, 3	
Clearances and Creepage between non mains-circuits and their environment (Overvoltage category II)							
DC/User to earth (functional)	60Vdc	--	0,20	1,75	0,20	1,75	
	NON PCB						
Main transformer primary – secondary	278	393,2	Already approved parts, see list of critical components				
Clearances and Creepage within a circuit							
	PCB						
DC to DC (functional)	60Vdc	--	Functional insulation 4.4.4.14				
AC to AC (functional)	230V	--	Functional insulation 4.4.4.14				
	NON PCB						
DC to DC (functional)	60Vdc	--	Functional insulation 4.4.4.14				
AC to AC (functional)	230V	--	Functional insulation 4.4.4.14				

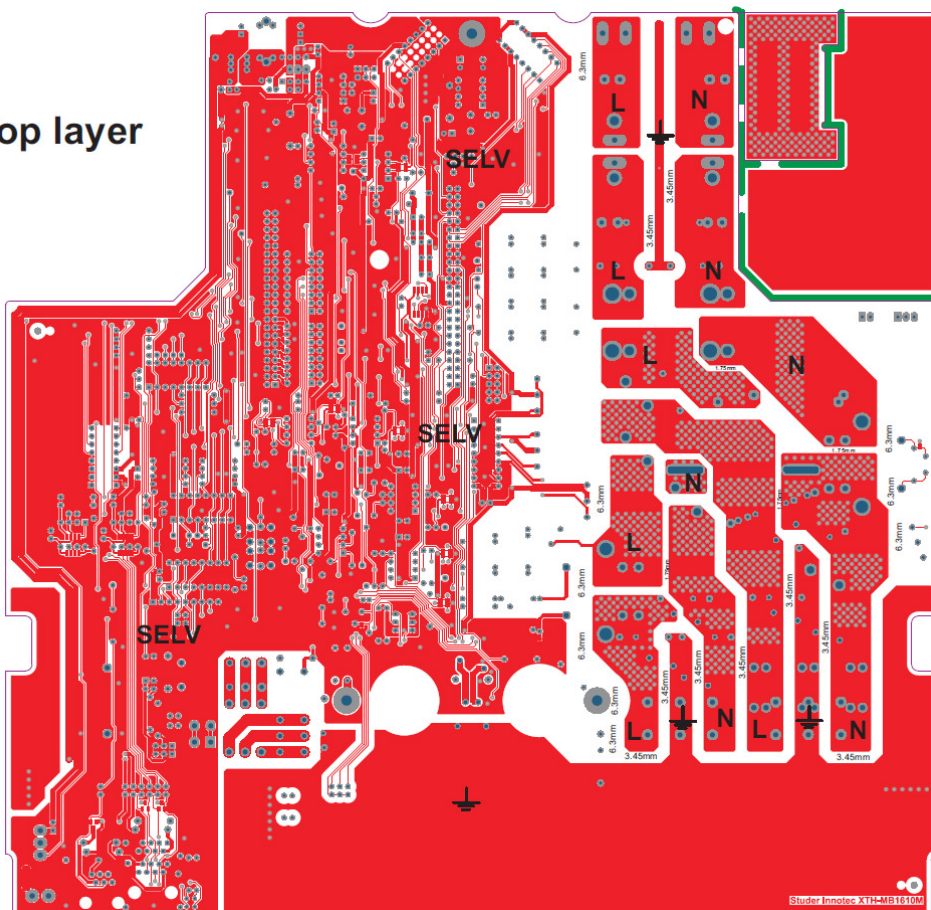
Comment:

Bottom layer



Mechanical 3 : mlling

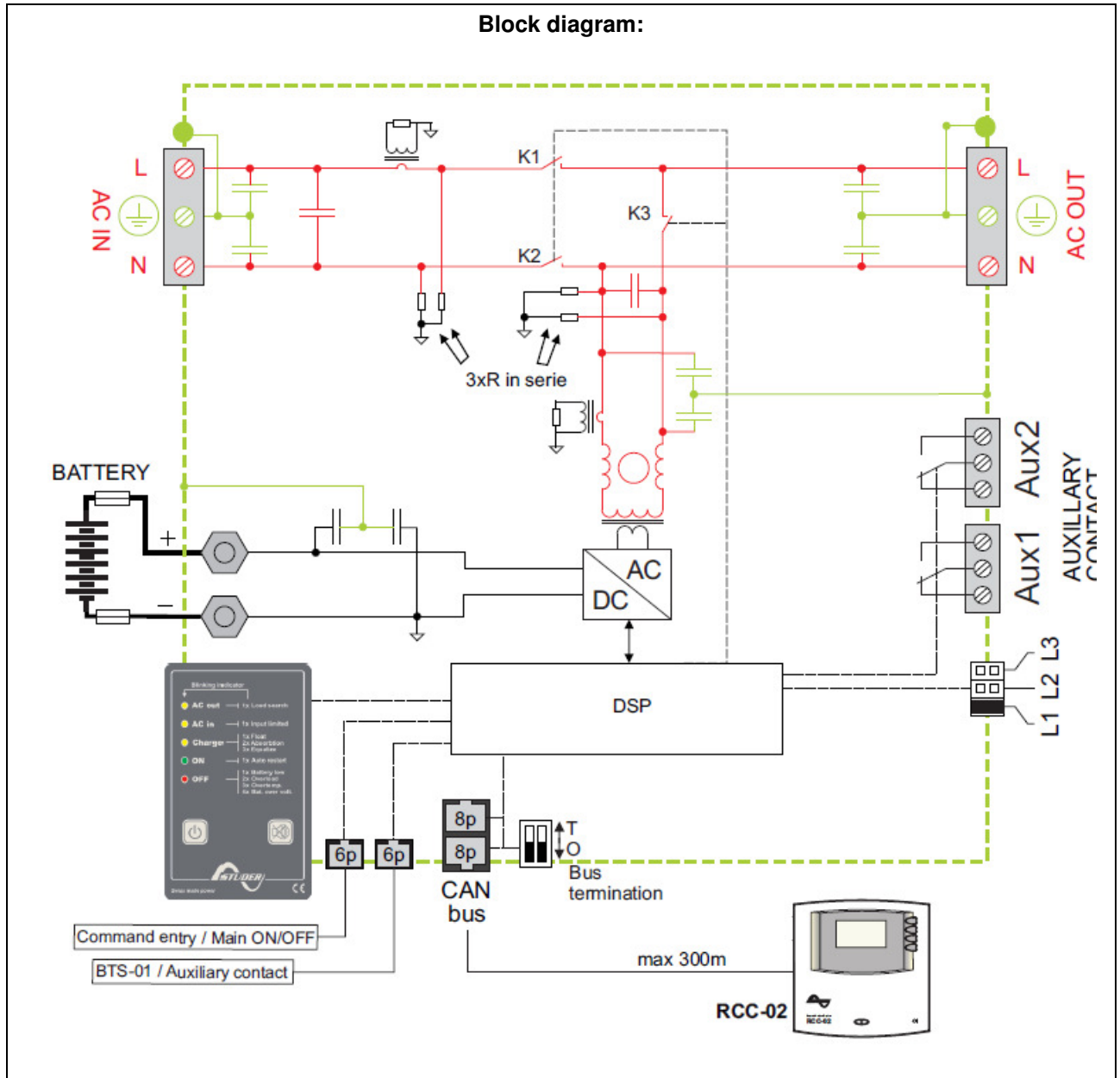
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Studer Innotes XTH-MB1610M

Mechanical 3 : mlling

Block diagram:



7.3.7.8.3.2 to 7.3.7.8.3.3	TABLE: distance through insulation measurement				P
distance through insulation di at/of:	U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)	
Already approved transformers used, see list of critical components					

7.3.9	TABLE: Capacitor discharge			P
A storage oscilloscope was connected across the external point of disconnection of the mains supply.				
Measurement location	Initial voltage	Time to decay to 60V or limit of 7.3.5.4	Inverter Status	
Line to Neutral	230V	Voltage of 34V after 1s	No load	
Comments:				
Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE. In the case of plugs, connectors, or similar devices that can be disconnected without the use of a tool, the withdrawal of which results in the exposure of conductors (e.g. pins), the discharge time to reduce the voltage to DVC A (See 7.3.2.2) or to a stored charge level below the limits specified in 7.3.5.4 shall not exceed 1s. Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE. Capacitors within a PCE shall be discharged to a voltage less than DVC A (See 7.3.2.2), or an energy level below the limits specified in 7.3.5.4, within 10 s after the removal of power from the PCE. If this requirement is not achievable for functional or other reasons, the warning symbol 21 of Table D-1 and an indication of the discharge time shall be placed in a clearly visible position on the enclosure, the capacitor protective barrier, or at a point close to the capacitor(s) concerned (depending on the construction). The time required for the capacitors to discharge after the removal of power from the PCE shall also be stated in the servicing instructions. See 5.3.4 for marking.				

7.4	TABLE: Determination of hazardous energy level				P
<i>The sample was connected to 230Vac and 48Vdc. With the unit operating normally, a variable resistor was connected across the points noted beside. The current through the resistor and voltage across the resistor were monitored using suitable meters. The resistance was adjusted to obtain maximum VA at a voltage exceeding 2 V.</i>					
Output Tested		Max. Volts	Max. Amps.	Max. VA	Hazard Energy YES/NO
Temperature Sensor connector		13,3	0,8	10,6	NO
Com Bus connector		13,3	0,8	10,6	NO
Comments: Battery Output is considered as hazardous energy level due to its rating.					

7.5	TABLE: impulse voltage test and partial discharge test			N/A
test voltage applied from:		To:	1,2/50us test im- pulse (kV)	breakdown Yes / No
Solid insulation (according to 7.3.7.8.4.1):				
Transient overvoltage limiting device (according to 14.7):				
Comment:				

7.5.2	TABLE: Voltage Test (dielectric strength test)		P
test voltage applied between:		Test voltage (V) ac/dc	breakdown Yes / No
AC (Mains and Load connected together) to PE		2120Vdc	P
AC to USER		4240Vdc	P
Insulation foil transformer		4240Vdc	P
AC (Mains and Load connected together) to Battery		4240Vdc	P
Comment: The varistors to PE were removed. Humidity preconditioning according to 4.5 was performed before this test <i>The test is used to verify that the clearances and solid insulation of components and of assembled PCE has adequate dielectric strength to resist overvoltage conditions. Routine tests are performed to verify that clearances and solid insulation have not been reduced or damaged during the manufacturing operations.</i>			

7.5.4	TABLE: Touch current measurement			P
<i>The unit was connected to 230 Vac, 60 Vdc and 50Hz. The outputs were loaded to the rated value. The current measuring circuit according to Figure 4 of IEC 60990 was taken.</i>				
Star mains equipment				
Parts tested	Measured volt- age (U2)	Calculated cur- rent (mA)	Comments	
Charging Mode				
Common point → Enclosure	0,0	0,0	Normal condition	
Common point → Enclosure	0,86	1,7	PE open	
Islanding operation				
Common point → Enclosure	0,0	0,0	Normal condition	
Common point → Enclosure	0,47	0,94	PE open	
Comments:				

8.2	TABLE: Moving parts			N/A
Part		Force	Observation	
Comments:				
Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin.				

8.3	TABLE: Stability			N/A
Part			Force	Observation
Comments: The unit is wall mounting equipment				

8.4	TABLE: Provisions for lifting and carrying			N/A
Part		Force	Observation	
Information about lifting and carrying are given in the manual				
Comments:				

8.5	TABLE: Wall mounting		P
Part		Force	Observation
XTH-8000-48		1380N	PASS
Comments:			
Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.			

9.2	TABLE: Limited power sources				N/A
<i>The maximum available output power was measured at nominal condition and with single fault conditions. The unit was connected to main nominal input voltage</i>					
Location of meas- urement	Condition	Voltage	Test Current in A	Calculated power	
Comments:					

10	TABLE: Protection Against Sonic Pressure Hazards			N/A
Comment	Limit:		Measured noise level	
Noise level	80 dBA			
Comments:				
<i>If equipment produces noise at a level that could cause a HAZARD, the noise shall be measured to determine the maximum sound pressure level that the equipment can produce (except that sound from alarms and from parts located remotely are not included). If the measured sound pressure exceeds 80 dBA above a reference sound pressure of 20 μP the instructions shall include information regarding how to reduce the risk of hearing damage to safe levels, and the product shall be marked with symbol 22 of Table D-1.</i> <i>Conformity is checked by inspection, measurement, and calculation of the maximum sound pressure level in accordance with ISO 3746 or ISO 9614-1.</i>				

13.1	TABLE: Handles and manual controls			N/A
Part		Force	Observation	
Comments:				
Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in a hazard.				

13.6.2	TABLE: Polymers serving as enclosures or barriers preventing access to hazards			N/A
Polymer Part			Test temperature (°C)	Observation
Comments:				

13.7.2	TABLE: 250-N deflection test for metal enclosures			P
The enclosure shall be held firmly against a rigid support and subjected to a steady force of 250 N applied for 5 s through the end of a rod having a 12,7 mm by 12,7 mm square, flat steel face.				
Part		Thickness	Force	Observation
Enclosure		2mm	250N	No deterioration
Note:				

13.7.3	TABLE: 7-J impact test for polymeric enclosures			N/A
A sample consisting of the enclosure or a portion thereof representing the largest non-reinforced area shall be supported in its normal position. A solid smooth steel sphere, approximately 50 mm in diameter and with a mass of 500 g ± 25 g, shall be permitted to fall freely from rest through a vertical distance of 1 300 mm onto the sample. Vertical surfaces are exempt from this test. In addition, the steel sphere shall be suspended by a cord and swung as a pendulum in order to apply a horizontal impact, dropping through a vertical distance of 1 300 mm. Horizontal surfaces are exempt from this test. A dielectric test from primary to earth and primary to secondary was conducted after the test.				
Part		Thickness	Observation	
Dielectric test after the steel ball test:				
Location		Insulation type	Potential used	Breakdown Yes/No

14.8.2	TABLE: Battery Mounting			N/A
Part	Thickness	Force	Observation	
No batteries in the sense of this clause mounted in the unit. CR2032 was tested in fault conditions				
Comments:				
<i>A battery shall be located and mounted so that the terminals of cells are not able to come into contact with terminals of adjacent cells, or with metal parts of the battery compartment, as the result of shifting of the battery.</i>				
<i>Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A nonmetallic rack or tray shall be tested at the highest normal condition operating temperature.</i>				

14	TABLE: List of critical components				P
Object/part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity ¹⁾
Enclosure	Studer Innotec SA	XTH 8000-48 XTH 6000-48 XTH 5000-24 XTH 3000-12	Metal, 302 x 484 x 229mm, min. 2mm thickness provided with 2mm diame- tervent openings on the bottom and 3mm on the back	-	Tested within the unit
On/Off Switch	Salecom Elec- tronics Co., Ltd.	T80-R series R8015	Max. 5A, 125Vac, 85°C,	ANSI/UL 60335-1	cURus E123142
Main board PCB Material	+ OMR Italia Or Estec	XTH-MB1610M, Xth-pow910Eb, DSP1210G, XTH:DISP1104F,	TG130-140°C, material FR4 UL 94 V-0	UL796	cURus E79991 cURus E194573
FANs	Y.S TECH	FD248025EB-N	80x80x25mm, 24V, 0.14A, flame resistance UL 94- V0	UL507	cURus E187205
Polycarbonate display	+Shen Zhen Sun- rising Electronic	XTH-KB-1004	Made with FPC, OMAY SE42 and NITTO 5011N materials. All are UL94V-0.	UL94V-0	cURus E52859 cURus E249605 URus E246440
Battery and AC cable glands	PROTEC GmbH	EPN250/PG21	Polyamid PA 6, flame resistance UL94V0, IP68- 100°C	UL94V-0, UL514B	cURus E204317
CAN cable gland	PROTEC GmbH	EPN250/PG13.5	Polyamid PA 6, flame resistance UL94, IP68, -30/100°C	UL94V-0, UL514B	cURus E204317
RJ11 and RJ45 connectors	Contact Technol- ogy Co.	Side Entry 8P8C SMT JACK PEG DIP	Material Polyam- ide PA9T UL94V- 0, 6 pins or 8 pins, voltage rat- ing 125Vac RMS, current rating 1.5A, dielectric strength 1000Vac RMS 1min.	UL94V-0	cULus E90350
Insulating foil for Induktor trans- formers	SYNFLEX, DUPONT TEIJIN FILMS	Mylar A Polyes- terfolie	0,05mm thick- ness, dielectric strength 8kV, flame characteris- tic VTM-2	UL94V-0	cULus E93687

Induktor power transformers	Induktor GmbH	BV311126, BV311123, BV201125	Isolating transformer, temperature class B (130°C), self-resetting thermal cut-out (built-in) "Klixon 2mmT115" 115°C, dielectric strength of 3740Vrms, IP00, frequency 50-60Hz, Class II, the foil for reinforced insulation is Mylar A and is UL certified.	ENEC licence according to IEC 61558-1 and 61558-2-4	ENEC18
InduComp power transformer	InduComp Kft	300456	Isolating transformer, temperature class E (120°C), self-resetting thermal cut-out (built-in) "Klixon 2mmT115" 115°C, dielectric strength of 3740Vrms, IP00, frequency 50-60Hz, ClassII	ENEC licence according to IEC 61558-1 and 61558-2-4	ENEC18
Relay K1, K2	TE connectivity	RT314012	12Vdc, 250Vac, 16A, max. 85°C	ANSI/UL 60947-1	cURus E214025
Capacitor C56	Okaya	LE155	275Vac, 1,5µF, 100°C	ANSI/UL 60384-14	cURus E47474
AC INPUT and AC OUTPUT connectors	Dinkle	ESK116	57A, 1000V, rated surge voltage cat3 4kV, flame characteristic UL94-V0 105°C	ANSI/UL 1059	cURus E102914
AC OUTPUT connector for XTH 8000-48	Phoenix Contact	MKDSP 25-15	125A, 1000V, rated surge cat3 8kV, flame characteristic UL94-V0,	UL 1059	cURus E60425
X2 filtering capacitors, C11, C20	Arcotronics, Kemet	MKP R46, RM27.5	275Vac, 560Vdc, 50-60Hz, flame characteristic UL94-V0 125°C	IEC 60384-14, IEC 60065	cURus E97797

Y2 filtering capacitors, C1, C2, C8, C10, C14, C16	Arcotronics, Kemet	MKP R41, RM15	300Vac, 1000Vdc, 50-60Hz, flame characteristic UL94-V0 110°C	IEC 60384-14, IEC 60065	cURus E97797
Power transfer relays K5, K6, K8, K10	Xiamen Hongfa Electroacoustic Co., Ltd.	HFE10-1	Dielectric strength coil/contacts 4000Vac 1min, dielectric strength open contacts 1500Vac 1min, 50A, 440Vac	UL 60947-1	cULus E134517
Electrolytic capacitors on battery side	Nippon Chemi-Con Corporation	U32D series	+105°C maximum temperature, 35Vdc for 12Vdc battery system, 50Vdc for 24Vdc battery system, 80Vdc for 48Vdc battery system.	IEC 60384-4	Accepted
The transfer current sensor, and inverter current sensor only for XTH 8000-48, SENS1	Induktor GmbH	BV10608-1	50Arms, 50Hz, Temperature class E (120°C), working voltage 250V, reinforced insulation according to IEC 60950-1 (4000V).	--	Accepted
The inverter current sensor, SENS3	Induktor GmbH	BV10666	32Arms, 50Hz, Temperature class E (120°C), working voltage 250V	Wire TEX-E IEC60950-1 and IEC60065, Wire insulation HIL-SHRINK 876 2:1 UL224 VW1, temperature class IEC 60085	Accepted
Varistors on AC side VR1 – VR6	+ Littelfuse	P420L20	420Vac; Diameter 14mm, max. Clamping Voltage 1120V	ANSI/UL 1449 IEC62643-331	cURus E320116
Battery	+ Varta	CR2032 V	Lithium/Manganese dioxide coin Cell (d) 3Vdc, 200mAh	UL 1642	URus MH28845

Supplementary information:

¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.

²⁾ + means, that components from other vendor and other model number, but with the same rating and equivalent approvals are accepted.

Annex No. 1

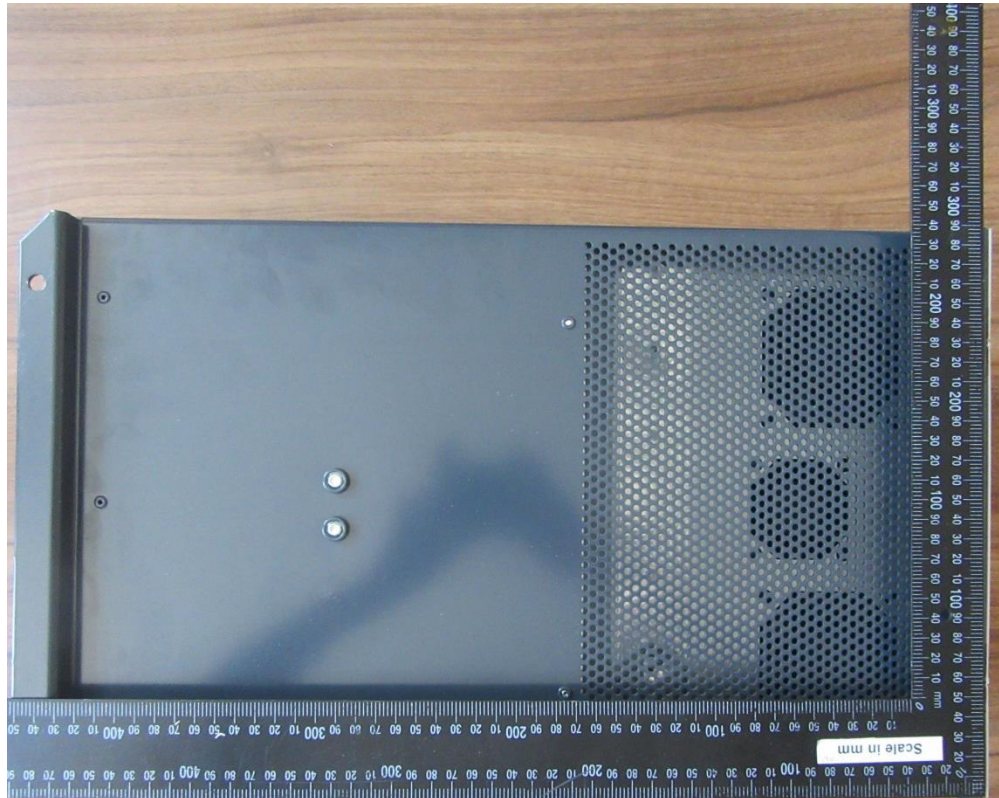
Pictures of the unit



Front side enclosure of the unit (additional warning mark required, see next picture).



Warning mark Hot surface on the unit



Rear side enclosure of the unit



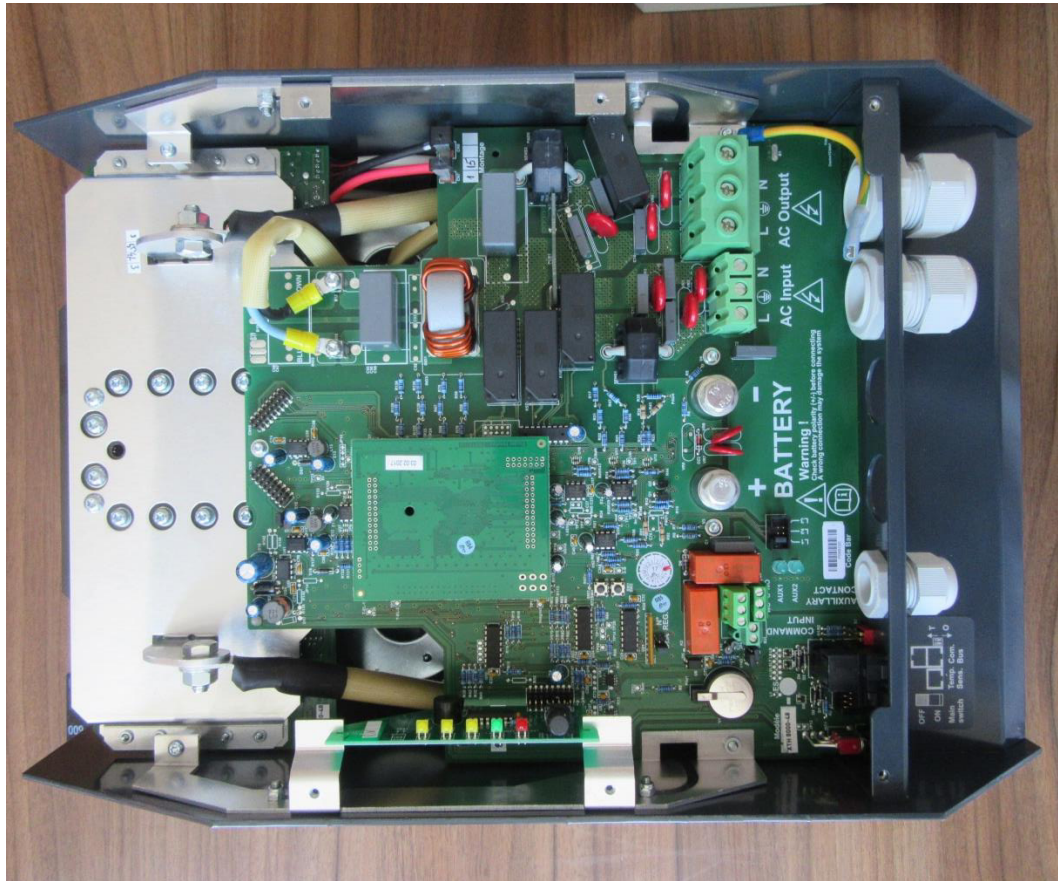
Side of the enclosure



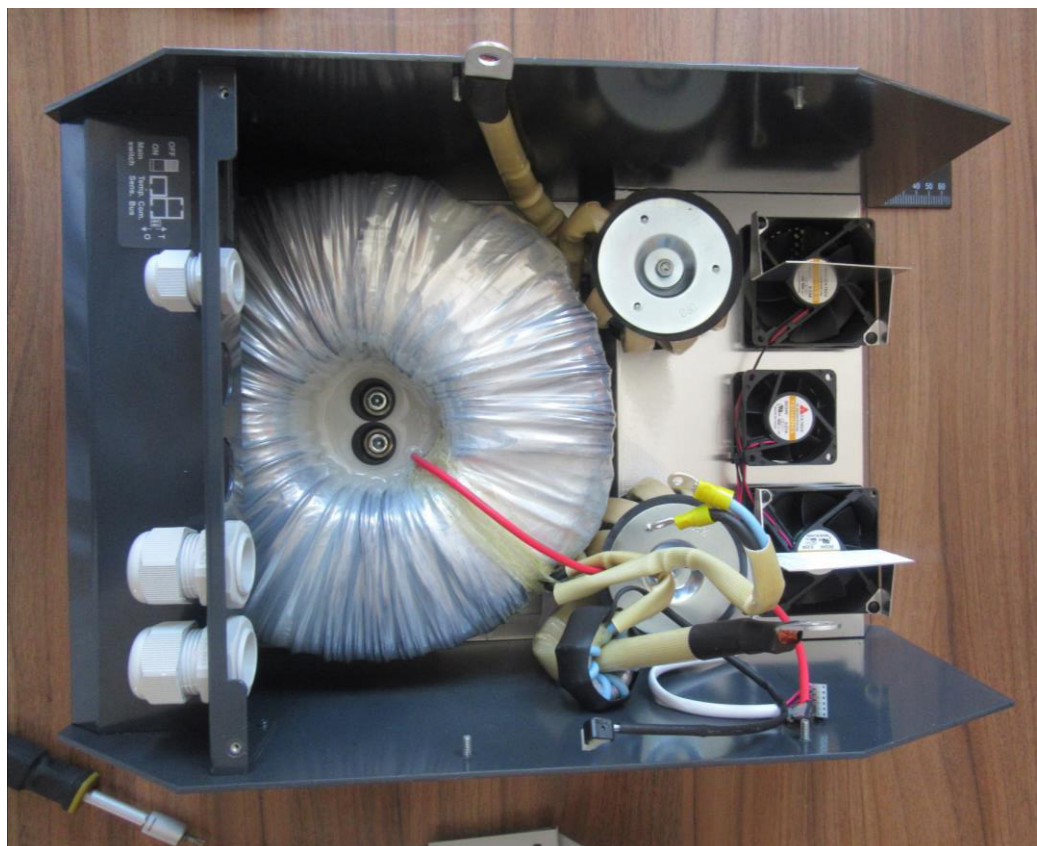
Top of the enclosure



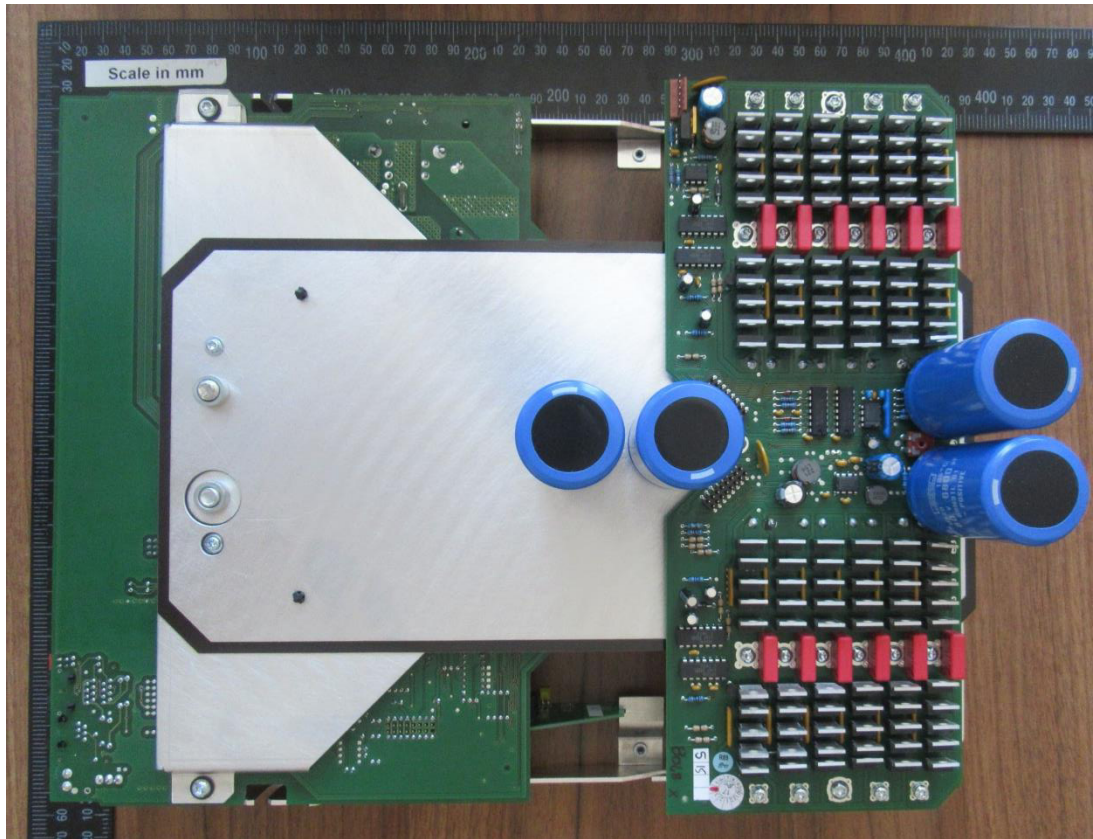
Bottom side of the enclosure



XTH-8000-48 without front cover



Transformer of model XTH-8000-48



Power PCB of model XTH-8000-48

Annex No. 2

Transformer drawings



Design, Development and Manufacturing of Inductive Components

Technische Spezifikation / Stand: 12.03.2014

PN:	300456	Kunde:	Studer Innotec
Bemessungsleistung:	5600VA		

Ortsfester Einphasen-Wechselstrom-Geräte-Trenntransformator (Einbauprodukt) nach EN 61558-1:2005+A1:2009 und EN 61558-2-4:2009 mit Glättungsdrosseln nach Kundenvorgabe
Trockentransformator / Bemessungs-Umgebungstemperatur $t_a = 40^\circ\text{C}$ / Temperaturklasse 120°C (E)
Bemessungsfaktor=1 / Die Bemessungsleistung darf nur bei ausreichender erzwungener Kühlung im Gerät des Anwenders übertragen werden. / Verschmutzungsgrad 2 / Schutzart IP00
Klassifikation nach der Betriebsdauer: Dauerbetrieb (bei externer Zwangskühlung)
Klassifikation nach Art des Schutzes gegen elektrischen Schlag: (Anmerkung: Gemäss EN61558-1 sind Einbau-Transformatoren nicht klassifiziert, die Art des Schutzes gegen elektrischen Schlag ist durch die Einbauart bestimmt):

für Schutzklasse II vorbereitet ☐

Isolierungen: Pri-Sek: Doppelte bzw. verstärkte Isolierung
Pri/Sek-TS: Doppelte bzw. verstärkte Isolierung
Schutz gegen nicht bestimmungsgemäßen Gebrauch:



Nicht kurzschlussfest Mit Thermoschalter zur externen Verdrahtung mit einer Elektronikschaltung. Vom Hersteller festgelegte Absicherung: siehe Kundeninformation Nr. 1-2 v. 29.6.2010 Absicherung von nicht kurzschlussfesten 50Hz Ringkerntransformatoren

Relative Kurzschlussspannung ohne Drosseln: $u_k=1,6\%$

Bemessungs-Eingangsspg./-Frequenz

Bemessungs-Ausgangsspannung/Strom

beige	Glättungsdrossel nach Kundenvorgabe 2 Kerne: S 306085A 10Wdg./Cu-Querschnitt 50qmm		
28,8V/50Hz~	Primärwicklung	Sekundärwicklung	blau 225V/24,9A Uo=230,4V
			rot 0V
0V	Glättungsdrossel nach Kundenvorgabe 2 Kerne: S 306085A 10Wdg./Cu-Querschnitt 50qmm		
rot			
rot			
		TS	115°C

Erklärungen: Uo= Leerlauf-Ausgangsspannung / TS=Selbsttätig zurückstellender Temperaturbegrenzer (Thermoschalter) Öffner,

Nennspannung 250Vac / Nennstrom max. 2,5ac

Leerlaufstrom bei $U_{in}=255V$ an Sekundärwicklung: max. 200mA RMS

Anmerkungen: Da Versorgungsspannungsschwankungen von $\pm 10\%$ auftreten können, müssen die Nenn-Ausgangswerte entsprechend gewählt werden. Es muss beachtet werden, dass unter Kurzschluss- oder Überlastbedingungen Wicklungstemperaturen von bis zu 215°C auftreten können.

Die Anschlussleitungen dieses Transformators können nicht ersetzt werden. Wenn die Leitung beschädigt ist, darf der Transformator nicht mehr betrieben werden.

Es gelten die Festlegungen der IEC 61558-1 und der oben angegebenen Ergänzungsteile. Die in §4.2 der EN 61558-1:2005 ausgenommenen Festlegungen werden durch die jeweiligen Gerätevorschriften des Kunden ersetzt. Die Verantwortung für die Einhaltung der Gerätevorschriften obliegt dem jeweiligen Anwender.

Diese Angaben in dieser Technischen Spezifikation entsprechen dem heutigen Stand unserer Kenntnisse und sollen über unsere Produkte und deren Anwendungsmöglichkeiten informieren. Sie haben somit nicht die Bedeutung, bestimmte Eigenschaften der Produkte oder deren Eignung für einen konkreten Einsatzzweck zuzusichern. Sie entbinden nicht von eigenen Prüfungen. Sie sind an Fachleute gerichtet, die sie nach eigenem Ermessen und auf eigene Gefahr verwenden. Die Angaben in dieser Technischen Spezifikation stellen keine zugesicherten Eigenschaften dar, sondern nur Produktbeschreibungen. Bei nicht spezifizierten Angaben in dieser Produktbeschreibungen gelten die Standards des Herstellers. Etwa bestehende gewerbliche Schutzrechte sind zu berücksichtigen. Eine einwandfreie Qualität gewährleisten wir im Rahmen unserer Allgemeinen Verkaufsbedingungen.

Zulassungen/ Kennzeichnungen: (Klassifikation gemäß Zulassungsunterlagen bzw. Konformitätserklärung)



Planung, Beratung, Entwicklung und Produktion Telefon (089) 897603 - 0 Telefax (089) 897603 - 33 INDUKTOR GmbH, Bodenseestr. 228, D-81243 München	induktor GmbH Ringkernbauelemente
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Belegungsplan/ Technische Spezifikation/ Pflichtenheft (Blatt 1 / 2)

BV: 201125 / 2000VA

Bemessungs-
Versorgungsspannung
Bemessungsfrequenz

6,6V ±10%
50/60Hz

schwarz 1

Glättungsdrossel 2:
Kern: CS777060E30
Al-Wert: 170nH
5 Wdg.
Cu-Querschnitt:
70mm²

braun

Bemessungs-Ausgangs-
spannung/-strom
Leerlaufspannung (U₀)

224V/8,93A
U₀=231V

0V

schwarz

Glättungsdrossel 1:
Kern: CS777060E30
Al-Wert: 170nH
5 Wdg.
Cu-Querschnitt:
70mm²

blau

0V

Messdrossel:

Kern: ZF44916TC / Al-Wert: 3540nH +/-25%

weiss

30 Wdg.

blau

35 Wdg.

weiss 1

blau

doppelte Isolierung

rot

rot

TWA
110°C

TWA=Selbsttätig zurückstellender ThermoSchalter / Nennspannung 250V~ / Nennstrom 2,5A max.

Planning, advice

development and production

of inductive components

Induktor GmbH, Bodenseestr. 228, D-81243 München, GERMANY
Phone.: +49 89 897603 - 0 Fax: +49 89 897603 - 33

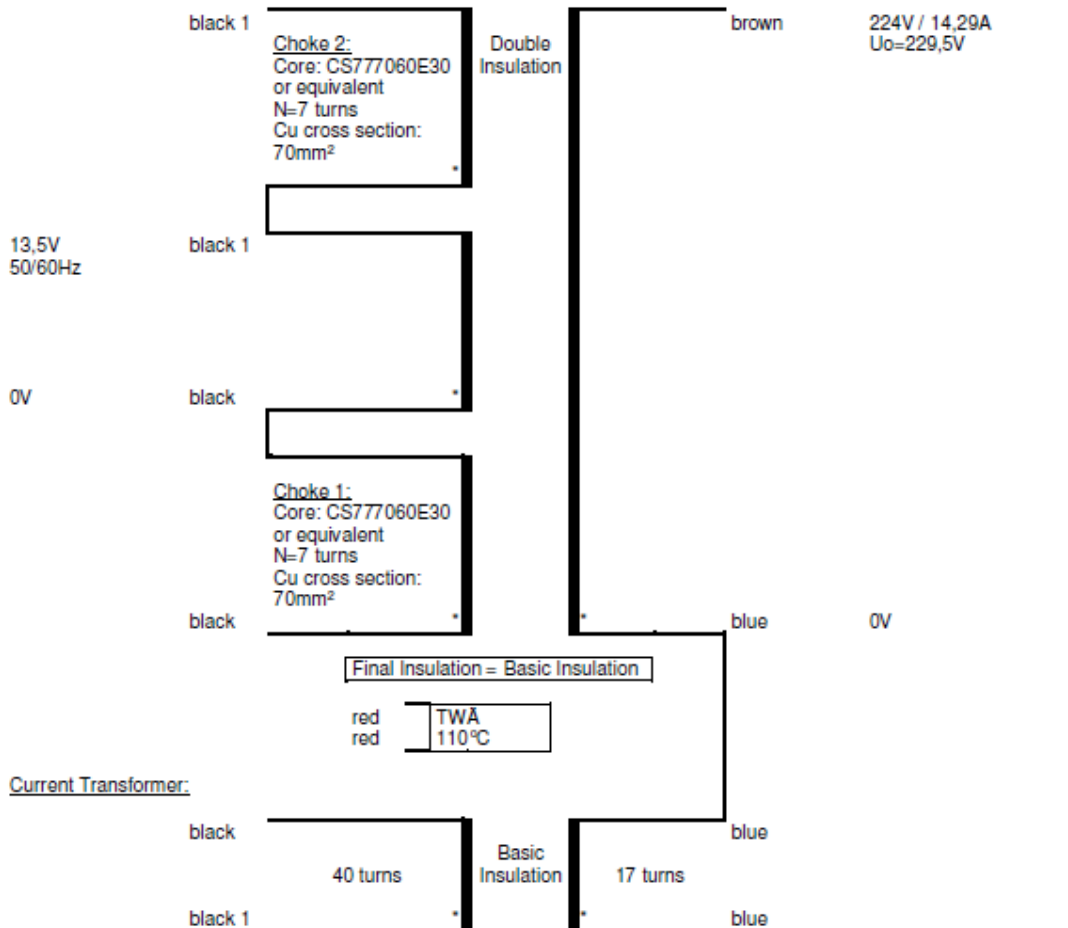


Circuit diagram/ Technical Specification (Page 1 / 2)

Typ: XTH	
Artikel: 201123	
BV: 311123 / 3200VA	Customer: Studer Innotec

Rated supply voltage
Rated frequency

Rated output voltage/-
current
No-load output voltage (U₀)



TWA=Self-resetting thermal cut-out / Rated voltage: 250V~ / max. Rated current: 2,5A RMS

Planning, advice

development and production

of inductive components



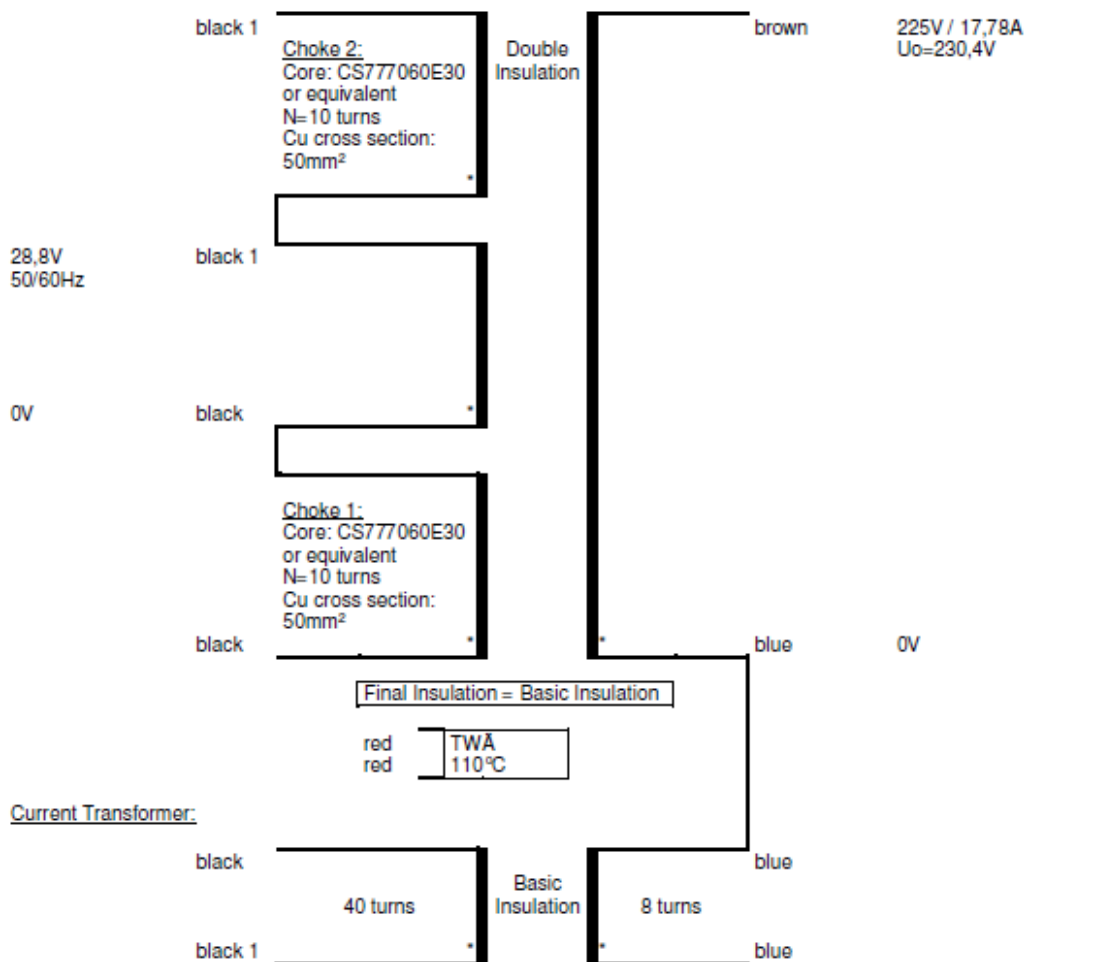
Induktor GmbH, Bodenseestr. 228, D-81243 München, GERMANY
Phone.: +49 89 897603 - 0 Fax: +49 89 897603 - 33

Circuit diagram/ Technical Specification (Page 1 / 2)

Typ: XTH	
Artikel: 201126	
BV: 311126 / 4000VA	Customer: Studer Innotec

Rated supply voltage
Rated frequency

Rated output voltage/-
current
No-load output voltage (U₀)



TWA=Self-resetting thermal cut-out  / Rated voltage: 250V~ / max. Rated current: 2.5A RMS

Annex No. 3

Test equipment list

Internal No.	Equipment	Manufacturer	Type	Serial No.	Last Calibration	Next Calibration
037	Leakage Meter IEC 60990, F4	SBF Electronic	BSM-500KK	2010BSM01V 01-QPS	30.08.2016	30.08.2017
050	Oscilloscope	Yokogawa	DLM2024	91K633899	20.04.2017	20.04.2018
066	Thermowire, Type K	Newport Electronics	TC-TT-KI-30-SLE-150M	N/A	10.02.2012	ICO
080	Petroleum spirit IEC60950;	Th. Geyer	N-Hexan	1929.1000	N/A	N/A
093	Balance / Weight Scale	Kern&Sohn	DE150K50NL	WD10002095 4	05.12.2016	05.12.2017
117	Dielectric Tester	SPS electronic GmbH	HA 3881G	11030102	27.04.2017	27.04.2018
147	Digital Multi-meter / Data-logger (Temp.)	Keithley	2701	1400850	01.12.2016	01.12.2017
220	Digital Caliper	Messmittelonline	3011	3106	N/A	N/A
260	Current Clamp	Fluke	323	23350116	19.04.2017	19.04.2018
308	Force meter	Chatillon	DFX2-050-NIST	W08728	01.11.2016	01.11.2017

The Equipment fulfills the requirements of PDSH 251E.

The uncertainties from the measurement method and the uncertainties of the test equipment has been identified and can be provided on request.