

TEST REPORT IEC 62477-1 Safety requirements for power electronic converter systems and equipment Part 1: General	
Report Reference No.:	288578-2
Date of issue	09.05.2017
Total number of pages	18
Applicant's name	Ensto Finland Oy
Address	Ensio Miettisen katu 2, FI-06150 Porvoo, Finland
Test specification:	
Standard	IEC 62477-1:2012 (First Edition)
Test procedure	Partial test
Non-standard test method.....	N/A
Test Report Form No.	IEC62477_1A
Test Report Form(s) Originator	VDE Testing and Certification Institute
Master TRF	Dated 2014-03
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Test item description	Phase Balancer
Trade Mark	ENSTO
Manufacturer	Ensio Miettisen katu 2, FI-06150 Porvoo, Finland
Model/Type reference	PB50A-3P-200STD, PB50A-3P-200ADV
Ratings	3x 230V ac 50/60Hz, 50A, IP55

Testing procedure and testing location:	
<input checked="" type="checkbox"/> CB Testing Laboratory:	SGS Fimko Ltd.
Testing location/ address	Särkiniementie 3 FI-00210, Helsinki Finland
<input type="checkbox"/> Associated CB Laboratory:	
Testing location/ address	
Tested by (name + signature)	
Approved by (+ signature)	

<input type="checkbox"/> Testing procedure: TMP/CTF Stage 1:
Testing location/ address
Tested by (name + signature)
Approved by (+ signature)

<input type="checkbox"/> Testing procedure: WMT/CTF Stage 2:
Testing location/ address
Tested by (name + signature)
Witnessed by (+ signature)
Approved by (+ signature)

<input type="checkbox"/> Testing procedure: SMT/CTF Stage 3 or 4:
Testing location/ address
Tested by (name + signature)
Approved by (+ signature)
Supervised by (+ signature)

List of Attachments (including a total number of pages in each attachment):

- ☒ Attachment 1: Photographic documentation, 6 pages
- ☒ Attachment 2: Technical Annex, 12 pages

Summary of testing:
Tests performed (name of test and test clause):

Only the creepage and clearance distance measurements and electrical tests have been carried out for the Ensto Phase Balancer.

All other clauses have been removed and/or marked with *) as not tested.

Testing location:

SGS Fimko Ltd.
Särkiniementie 3, FI-00210 Helsinki, Finland

Summary of compliance with National Differences:

List of countries addressed:

-

Copy of marking plate:

Example: Phase Balancer PB50A-3P-200STD

[Ensto Logo]	Ensto	Finland	
	Phase	Balancer	
	Type	PB50A-3P-200STD	
	Vn	3x 230V ac 50/60Hz	
	In	50A	
	Current bal- ancing ca- pacity	50A	
	Fuse	35A / 500V / gG 000	
	Network	TN/TT	
	Casing	IP55	
	Mass	125kg	
	Serial no	yyyy-mm-0000	[CE]
	Made in	EU	
	Ensto Finland Oy P.O.Box 77 06101 Porvoo Finland www.ensto.com		

Test item particulars	
Classification of installation and use	Outdoor unconditioned
Supply Connection	230VAC (TN, TT).
Possible test case verdicts:	
- test case does not apply to the test object.....	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement.....	F (Fail)
Testing	
Date of receipt of test item	28.02.2017
Date (s) of performance of tests	06.04 –24.04.2017
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</p> <p><i>This document is issued by the Company under its General Conditions of service accessible at http://www.sgs.com/terms_and_conditions.htm attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.</i></p> <p><i>Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.</i></p> <p><i>Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. This document cannot be reproduced except in full, without prior approval of the Company.</i></p>	

Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided

- ☐ Yes
☒ Not applicable

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) : Oy Darekon Ltd
Yrittäjätie 13, 01800 Klaukkala, Finland

General product information:

The Ensto Phase Balancer PB50A-3P-200STD and PB50A-3P-200ADV have been designed to balance voltage between phases when one phase is asymmetrically loaded.

The construction and components are identical between models PB50A-3P-200STD and PB50A-3P-200ADV except following parts:

PB50A-3P-200ADV (tested model)

- with protective voltage transformer (AUX) and fuse holders with glass tube fuses for L1-L3 and N
- with protective voltage indicating lamps (red and green)
- with PWB which includes current measurement and communication option with user touchable PELV-circuit
- with protective voltage controlled main contactor
- with temperature sensors in main transformer (part of PELV-circuit)

PB50A-3P-200STD

- no protective voltage transformer (AUX)
- 230V indicating lamps (red and green)
- no PWB which includes current measurement and communication option with user touchable PELV-circuit
- 230V controlled main contactor
- temperature switch circuit in main transformer and fuse holders with glass tube fuses for one phase and N (this is part of main contactor control circuit)

The PEN cable is connected to the star point of the main transformer and primary side of the AUX transformer. The equipment metal enclosure shall be grounded to earth potential. The PEN cable is connected to this same ground but it is done outside of the equipment.

The PWB, temperature sensor circuit and AUX transformer contains reinforced insulation between mains voltage and PELV.

Ratings for the Ensto Phase Balancer PB50A-3P-200STD and PB50A-3P-200ADV are as follows:

- Fixed installation with permanent connection for outdoor use.
- OVC IV (mains).
- PD2 (internally)
- IP55 (declared by manufacturer)
- 3x230VAC, 50Hz, I(in) 50A (3x17A)

Additional test item particulars :	
Equipment mobility:	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input type="checkbox"/> stationary <input checked="" type="checkbox"/> fixed <input type="checkbox"/> transportable <input type="checkbox"/> for building-in
Connection to the mains :	<input type="checkbox"/> pluggable equipment <input type="checkbox"/> direct plug-in <input checked="" type="checkbox"/> permanent connection <input type="checkbox"/> for building-in
Environmental category :	<input checked="" type="checkbox"/> outdoor <input type="checkbox"/> indoor <input type="checkbox"/> indoor unconditional conditional
Over voltage category Mains :	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input checked="" type="checkbox"/> OVC IV
Over voltage category PV :	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Mains supply tolerance (%) :	-
Tested for power systems :	TN, TT.
IT testing, phase-phase voltage (V) :	N/A
Class of equipment :	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input checked="" type="checkbox"/> Not classified
Mass of equipment (kg) :	125
Pollution degree :	2
IP protection class :	IP55
For more information: see table 4 :	

IEC 62477-1			
Clause	Requirement – Test	Result – Remark	Verdict
4	PROTECTION AGAINST HAZARDS		
4.1	General		*)
4.2	Fault and abnormal conditions		*)
4.3	Short-circuit and overcurrent protection		*)
4.4	Protection against electric shock		P
4.4.1	General		P
4.4.2	Decisive voltage classification		P
4.4.3	Provision for basic protection		P
4.4.4	Provision for fault protection		*)
4.4.5	Enhanced protection		*)
4.4.6	Protective measures		*)
4.4.7	Insulation		P
4.4.7.1	General		P
4.4.7.1.1	Influencing factors		P
4.4.7.1.2	Pollution degree	PD2	P
4.4.7.1.3	Overvoltage category (OVC)	OVC IV	P
4.4.7.1.4	Supply earthing systems	TN, TT	P
4.4.7.1.5	Determination of impulse withstand voltage and temporary overvoltage	Impulse withstand voltage for basic insulation: 6000V	P
4.4.7.1.6	Determination of the system voltage		P
4.4.7.1.6.1	For mains supply	300 V	P
4.4.7.1.7	Components bridging insulation	Aux-transformer: reinforced insulation Protective impedance on PWB through resistor chain: reinforced insulation Temperature sensors: reinforced insulation	P
4.4.7.2	Insulation to the surroundings		P
4.4.7.2.1	General		P
4.4.7.2.2	Circuits connected to mains supply		P
4.4.7.2.3	Circuits connected to Non-mains supply	PELV circuit	P
4.4.7.2.4	Insulation between circuits		P
4.4.7.3	Functional insulation		P
4.4.7.4	Clearance distance		P
4.4.7.4.1	Determination	See Table 4.4.7.4	P

	<p>Clearances for functional, basic and supplementary insulation shall be dimensioned according to Table 10 (see Annex D for examples of the evaluation of clearance distances). Interpolation is permitted, when clearance is determined from temporary over-voltage or working voltage.</p> <p>Clearances for reinforced insulation shall be dimensioned to withstand an impulse voltage one step higher than the impulse withstand voltage, or 1,6 times the peak temporary overvoltage or peak working voltage, required for basic insulation.</p> <p>Clearance distances for use in altitudes between 2 000 m and 20 000 m shall be calculated using a correction factor according to Table A.2 of IEC 60664-1:2007, which is reproduced as Table E.1.</p> <p>A correction factor selected from Table F.2 is also used for determination of clearance distances for approximately homogenous fields when frequencies are greater than 30 kHz, as given in Annex F.</p>	<p>Functional insulation: 3,0 mm</p> <p>Basic insulation: 5,5 mm</p> <p>Reinforced insulation: 8,0 mm</p>	P
	<p>Compliance shall be checked by visual inspection (see 5.2.2.1) or by performing the impulse voltage test of 5.2.3.2 and the a.c. or d.c. voltage test of 5.2.3.4.</p>	<p>Visual inspection and by performing the impulse voltage test of 5.2.3.2 and the a.c. or d.c. voltage test of 5.2.3.4.</p>	P
4.4.7.4.2	Electric field homogeneity		N/A
4.4.7.4.3	Clearance to conductive enclosures		*)
4.4.7.5	Creepage distance		P
4.4.7.5.1	Insulating material groups		P
4.4.7.5.2	Determination	See Table 4.4.7.5	P
	<p>Creepage distances for functional, basic and supplementary insulation shall be dimensioned according to Table 11. Interpolation is permitted. Creepage distances for reinforced insulation shall be twice the distances required for basic insulation.</p>		P
	<p>When the creepage distance requirement determined from Table 11 is less than the clearance distance required by 4.4.7.4.1 or the clearance distance determined by impulse testing (see 5.2.3.2), then the creepage distance shall be increased to the clearance distance.</p>		P
	<p>Compliance of creepage distances shall be checked by measurement or inspection (see 5.2.2.1) (see Annex D for examples of the evaluation of creepage distances).</p>		P
4.4.7.6	Coating		N/A
4.4.7.7	PWB spacings for functional insulation		P
	<p>Spacings for functional insulation shall comply with the requirement of 4.4.7.4 and 4.4.7.5.</p>		P

	<p>Decreased spacings on PWB are permitted when all the following are satisfied:</p> <ul style="list-style-type: none"> • the PWB has flammability rating of V-0 (see IEC 60695-11-10); • the PWB base material has a minimum CTI of 100; • the equipment complies with the PWB short circuit test (see 5.2.4.7). <p>Decreased spacings for components assembled on PWB are permitted when used in:</p> <ul style="list-style-type: none"> • pollution degree 1 or 2 environment; and • not more than overvoltage category I. <p>In this case the manufacture specification may be used.</p> <p>Compliance is checked by inspection and by test of 5.2.4.7 if applicable.</p>		N/A
4.4.7.8	Solid insulation		P
4.4.7.8.1	General		P
4.4.7.8.2	Material requirements		*)
4.4.7.8.3	Thin sheet or tape material		P
4.4.7.8.3.1	General	See Table 4.4.7.8.3.2	P
	<p>4.4.7.8.3 applies to the use of thin sheet or tape materials in assemblies such as wound components and bus-bars.</p> <p>Insulation consisting of thin (less than 0,75 mm) sheet or tape materials is permitted, provided that it is protected from damage and is not subject to mechanical stress under normal use.</p> <p>Where more than one layer of insulation is used, there is no requirement for all layers to be of the same material.</p> <p>NOTE 1 One layer of insulation tape wound with more than 50 % overlap is considered to constitute two layers.</p> <p>NOTE 2 Basic, supplementary and double insulation can be applied as a pre-assembled system of thin materials.</p>	<p>AUX transformer: 5 x mylar (0,10mm) between pri-sec.</p> <p>Temperature sensor and bi metallic thermostat (temperature switch circuit) both with potted casing and: 1 x nomex/mylar (0,16mm) between casing and DVC C parts.</p>	P
4.4.7.8.3.2	Material thickness $\geq 0,2$ mm		N/A
4.4.7.8.3.3	Material thickness less than 0,2 mm		P
	Basic or supplementary insulation shall consist of at least two layers of material, which will meet the requirements of 4.4.7.8.1 and 4.4.7.10.1.	Temperature sensor and bi metallic thermostat (temperature switch circuit) both with potted casing and: 1 x nomex/mylar (0,16mm) between casing and DVC C parts.	P
	Double insulation shall consist of at least three layers of material. Each layer shall meet the requirements of 4.4.7.8.1 and 4.4.7.10.1, and any two layers together shall meet the requirements of 4.4.7.10.2.	AUX transformer: 5 x mylar (0,10mm) between pri-sec.	P

	Reinforced insulation consisting of a single layer of material is not permitted.		N/A
4.4.7.8.3.4	Compliance		
	Compliance shall be checked by the tests described in 5.2.3.1 to 5.2.3.5. When a component or sub-assembly makes use of thin sheet insulating materials, it is permitted to perform the tests on the component rather than on the material.		P
4.4.7.8.4	Printed wiring boards (PWBs)		P
4.4.7.8.4.1	General		P
	Insulation between conductor layers in double-sided single-layer PWBs, multi-layer PWBs and metal core PWBs, shall meet the requirements of 4.4.7.8.1. Basic, supplementary, double and reinforced insulation shall meet the appropriate requirements of 4.4.7.10.1 or 4.4.7.10.2. Functional insulation in PWBs shall meet the requirements of 4.4.7.7. For the inner layers of multi-layer PWBs, the insulation between adjacent tracks on the same layer shall be treated as either: • a creepage distance for pollution degree 1 and a clearance as in air (see Example D.14); or • solid insulation, in which case it shall meet the requirements of 4.4.7.8.1 and 4.4.7.10.	Functional insulation. Reinforced insulation.	P
4.4.7.8.4.2	Use of coating materials		N/A
4.4.7.8.5	Wound components	AUX transformer	P
4.4.7.8.6	Potting materials	Temperature sensor and bi metallic thermostat, see 4.4.7.8.3.3	P
4.4.7.9	Connection of parts of solid insulation (Cemented joints)		N/A
4.4.7.10	Requirements for electrical withstand capability		P
4.4.7.10.1	Basic or supplementary insulation	See Table 4.4.7.10	P
	Test with impulse withstand voltage according to 5.2.3.1		P
	Test with a.c. or d.c. voltage according to 5.2.3.4		P
4.4.7.10.2	Double and reinforced insulation	See Table 4.4.7.10	P
	Double or reinforced insulation shall be tested as follows: • Test with impulse withstand voltage according to 5.2.3.2; and • Test with a.c. or d.c. voltage according to 5.2.3.4.		P

	For solid insulation, the partial discharge test according to 5.2.3.5 shall be performed in addition to the above tests, if the recurring peak working voltage across the insulation is greater than 750 V and the voltage stress on the insulation is greater than 1 kV/mm. The partial discharge test shall be performed as a type test on all components, sub-assemblies and PWB. In addition, a sample test shall be performed if the insulation consists of a single layer of material.	The recurring peak working voltage across the insulation is less than 750 V and the voltage stress on the insulation is also less than 1 kV/mm.	N/A
	Double insulation shall be designed so that failure of the basic insulation or of the supplementary insulation will not result in reduction of the insulation capability of the remaining part of the insulation.		P
4.4.7.11	Insulation requirements above 30 kHz		N/A
4.4.8	Compatibility with residual current-operated protective devices		N/A
4.4.9	Capacitor discharge		N/A
4.5	Protection against electrical energy hazards		*)
4.6	Protection against fire and thermal hazards		*)
4.7	Protection against mechanical hazards		N/A
4.8	Equipment with multiple sources of supply		N/A
4.9	Protection against environmental stresses		*)
4.10	Protection against Sonic Pressure Hazards		N/A
4.11	Wiring and connections		*)
4.12	Enclosures		*)

5	TEST REQUIREMENTS		
5.1	General		P
5.1.1	Test objectives and classification		P
5.1.2	Selection of test samples		P
5.1.3	Sequence of tests		P
5.1.4	Earthing conditions		P
5.1.5	General conditions for tests		P
5.1.5.1	Application of tests		P
	Unless otherwise stated, upon conclusion of the tests, the equipment need not be operational.		P
5.1.5.2	Test samples		P
5.1.5.3	Operating parameters for tests		P
5.1.6	Compliance		P
5.1.7	Test overview		P
5.2	Test specifications		P

5.2.1	Visual inspections (type test, sample test and routine test)		P
	Before type testing, a check shall be made that the PECS delivered for the test is as expected with respect to supply voltage, input and output ranges, etc.		P
5.2.2	Mechanical tests		P
5.2.2.1	Clearances and creepage distance (type test)		P
	It shall be verified by measurement or visual inspection that the clearance and creepage distances comply with 4.4.7.4 and 4.4.7.5.		P
	Where this verification is impossible to perform, an impulse voltage test (see 5.2.3.2) shall be performed between the considered circuits.		P
5.2.2.2	Non-accessibility test (type test)		N/A
5.2.2.3	Ingress protection test (IP rating) (type test)		N/A
5.2.2.4	Enclosure integrity test (type test)		N/A
5.2.3	Electrical tests		P
5.2.3.1	General		
	The electrical tests described in 5.2.3.2 to 5.2.3.5 are applicable to basic, supplementary and reinforced insulation. Before performing these tests, preconditioning according to 5.2.6.3.1 and 5.2.6.3.2 is required.		P
	When performing electrical and preconditioning tests, the preferred procedure is to test the entire equipment; however it is acceptable to test the components or sub-assemblies providing the basic and reinforced insulation. When components or sub-assemblies are tested, test conditions shall simulate the least favourable conditions occurring inside the equipment at the place of installation.		P
5.2.3.2	Impulse voltage test (type test and sample test)	See Table 4.4.7.10	P
5.2.3.3	Alternative to Impulse voltage test (type test and sample test)		N/A
	An a.c. or d.c. voltage test according to 5.2.3.4 may be used as an alternative method to the impulse voltage test of 5.2.3.2.		N/A
	For an a.c. voltage test the peak value of the a.c. test voltage shall be equal to the impulse test of Table 25 and applied for three cycles of the a.c. test voltage.		N/A
	For a d.c. voltage test the average value of the d.c. test voltage shall be equal to the impulse test voltage of Table 25 and applied three times for 10 ms in each polarity.		N/A
	See IEC60664-1 clause 6.1.2.2.2 for further information.		N/A

5.2.3.4	A.C. or d.c. voltage test (type test and routine test)		P
5.2.3.4.1	Purpose of test		P
	The test is used to verify that the clearances and solid insulation of components and of assembled PSCS has adequate dielectric strength to resist temporary overvoltage conditions.		P
5.2.3.4.2	Value and type of test voltage		P
	<p>The values of the test voltage for circuits connected to mains supply are determined from column 2 or 3 of Table 26.</p> <p>The voltage test shall be performed with a sinusoidal voltage at 50 Hz or 60 Hz. If the circuit contains capacitors the test may be performed with a d.c. voltage of a value equal to the peak value of the specified a.c. voltage.</p>		P
5.2.3.4.3	Performing the voltage test	See table 4.4.7.10	P
	<p>a) Test (1) between accessible conductive part 8connected to earth) and each circuit sequentially (except DVC As circuits). Test voltage according to Table 26, or Table 27, column 2, corresponding to voltage of considered circuit under test.</p> <p>Test (2) between accessible surface (non-conductive or conductive but not connected to earth9 and each circuit sequentially (except DVC As circuits). Test voltage according to Table 26 or Table 27, column 3 (for type test) or column 2 (for routine test), corresponding to voltage of considered circuit under test.</p>		P
	b) Test between each considered circuit sequentially and the other adjacent circuits connected together. Test voltage according to Table 26 or Table 27, column 2, corresponding to voltage of considered circuit under test.		P
	c) Test between DVC As circuit and each adjacent circuit sequentially. Test voltage according to Table 26 or Table 27, column 3 (for type test) or column 2 (for routine test), corresponding to the circuit with the higher voltage. Either the adjacent circuit or the DVC As circuit may be earthed for this test. It is necessary to test functional insulation between PELV and SELV circuits, but it is not necessary to test functional insulation between adjacent PELV or adjacent SELV circuits.		P
5.2.3.4.4	Duration of the a.c. or d.c. voltage test		P

	The duration of the test shall be at least 60 s for the type test and 1 s for the routine test. The test voltage may be applied with increasing and/or decreasing ramp voltage but the full voltage shall be maintained for 60 s and 1 s respectively for type and routine tests.		P
5.2.3.4.5	Verification of the a.c. or d.c. voltage test		P
	The test is successfully passed if no electrical breakdown occurs during the test.		P

5.2.4	Abnormal operation and simulated faults tests	*)
5.2.5	Material tests	*)
5.2.6	Environmental tests (type test)	*)

6	INFORMATION AND MARKING REQUIREMENTS	*)
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4	TABLE: mains supply electrical data in normal condition					P
Type	U (V) DC	I (A) DC	P (kW) DC	U (V) grid	I (A) AC	P (kW) AC
TN, TT	-	-	-	3x230Vac	50A (3x17A)	-

4.2 to 4.3	TABLE: fault condition tests	*)
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4.6.4	TABLE: heating temperature rise measurements	*)
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4.4.7.4 to 4.4.7.5	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 dcr (mm)	dcr (mm)
Functional :						
Between phases L1/L2/L3 (Main fuse switch)	563	400	3,0	13,0	4,0*	22,0
Basic/supplementary:						
L1/L2/L3 – ground (PWB X1 and X2 – metal enclosure below)	325	230	5,5	10,7	5,5	-
L1/L2/L3 – ground (Main fuse switch - metal enclosure)	325	230	5,5	18,2	5,5	24,0
Reinforced:						
L1/L2/L3 – PELV (PWB X1 and X2 through resistor chains)	325	230	8,0	8,0	8,0	8,0
Pri – Sec (AUX transformer)	325	230	8,0	8,2	8,0	8,2
Supplementary information: *assume: CTI IIIa/b						

4.4.7.8.3.2 to 4.4.7.9	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)	
5 x mylar (0,10mm) between pri-sec (see clause 4.4.7.8)	230 V	3000 Vac	- (three layers)	0,5 mm (five layers)	
Potting material (temperature sensor and bi metal-lic thermostat, see clause 4.4.7.8)	230 V	3000 Vac	-	-	

4.4.7.10	TABLE: electric strength measurements, impulse voltage test and partial discharge test			P
test voltage applied between:	test voltage (V)	impulse with-stand voltage (V)	partial discharge extinction voltage (V)	result
Aux transformer Pri – Sec solid insulation, one layer*	1500 Vac	6000 Vac	N/A	P
Aux transformer Pri – Sec solid insulation, two layers*	3000 Vac	8000 Vac	N/A	P
Aux transformer Pri – Sec clearances		9800 Vac		
Mains circuit – temperature sensor and bi metallic thermostat	3000 Vac	8000 Vac	N/A	P
Mains circuit – ground (metal enclosure) solid insulation	1500 Vac	6000 Vac	N/A	P
Mains circuit – ground (metal enclosure) clearances		7400 Vac		
Supplementary information: *Tested as follows: Double insulation shall consist of at least three layers of material. Each layer shall meet the requirements of 4.4.7.8.1 and 4.4.7.10.1, and any two layers together shall meet the requirements of 4.4.7.10.2.				

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity ¹⁾	
PCB	Several	Several	CTI > 175, UL 94V-0	IEC 62477-1:2012	Tested in equipment and separately according to clauses 5.2.3.2 and 5.2.3.4	
Main fuse switch	Apator	RBK00 PRO	In: 160A Un: 690V ~			
Main fuse		Gg000	35A, 500V			
Main transformer, Zigzag transformer	Noratel	6-089-736972 or 6-089-741831	35A			
Contactor (STD-model)	ABB / Schneider	AF38-30-00-13 or LC1D38P7 + LAD4VU	230Vac			
Contactor (ADV-model)		AF38-30-00-11 or LC1D38BL	24Vdc			
Fuse holder	Schneider	NSYTRV42SF5	-			
Fuse		T (timed)	1A			
Aux-transformer	Noratel	6-010-746321	400V/30V 30VA 47/63Hz			
	DuPont	Thin sheet solid insulation: Mylar	0,1mm			

List of measurement units used for investigation

Clause	Unit	Type	Calibration date	Expiration date	Fixtures-No.
5.2.3.2 5.2.3.4	Hi Voltage tester	Sefelec RXS500	05.10.2016	05.10.2017	-
	Hi Voltage tester	Sefelec RXS506	17.08.2016	17.08.2017	-
	HighV probe	HVT 40 RCR	03.06.2015	02.06.2017	-
	Impulsetester	Passonvilla	Checked with 7533 and 9664		-
	Oscilloscope	Tektronix TDS 3014B	24.02.2017	24.02.2018	-
	Digital Multimeter	Fluke 289	10.10.2016	10.10.2017	-
5.2.3.2	Climate Chamber	Weiss	02.06.2016	02.06.2017	-
5.2.3.4 preconditioning	Temp/RH% meter	Vaisala	13.09.2016	13.09.2017	-
5.2.2.1	Digital caliper	Mitutoyo	29.12.2016	29.12.2017	-