






TEST REPORT IEC 61439-2 Low-voltage switchgear and controlgear assemblies - Part 2: Power switchgear and controlgear assemblies	
Report Number.....	
Tested by (name + signature)	
Approved by (name + signature).....	
Date of issue.....	2017-05-03
Total number of pages	12
CB Testing Laboratory	SGS Fimko Ltd
Testing location/ address	Särkiniementie 3, FIN-00210 HELSINKI, FINLAND
Applicant's name	
Ensto Finland Oy	
Address	
Tekniikkatie 12, FI-02150 ESPOO, FINLAND	
Test specification:	
Standard.....	IEC 61439-2:2011 (Second Edition)
Test procedure	Investigation scheme
Non-standard test method.....	N/A
Test Report Form No.	IEC61439_2B
Test Report Form(s) Originator	DEKRA Certification B.V. / SGS FIMKO
Master TRF	Dated 2011-07 ; Dated 2012-11
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Test item description.....	Phase balancer
Trade Mark	ENSTO
Manufacturer	Ensto Finland
Model/Type reference	PB50A-3P-XXXXXX
Ratings	U _n 230 Vac, f _n 50/60 Hz, I _{nA} 50 A, IP55

List of Attachments (including a total number of pages in each attachment): N/A																																																				
Summary of testing: Product fulfils requirements of tested parts. To Phase balancer conducted to dielectric test, impulse withstand test and clearance / creepage measurements. Printed circuit board and transformer were excluded from these tests and measurements.																																																				
Tests performed (name of test and test clause): Clause 9.1 Clause 10.4	Testing location: Own premises																																																			
Summary of compliance with National Differences List of countries addressed: N/A <input type="checkbox"/> The product fulfils the requirements of ____ - ____ (insert standard number and edition and delete the text in parenthesis or delete the whole sentence if not applicable)																																																				
Copy of marking plate <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 35%;">Ensto</td> <td style="width: 50%;">Finland</td> </tr> <tr> <td></td> <td>Phase</td> <td>Balancer</td> </tr> <tr> <td></td> <td>Type</td> <td>PB50A-3P-200STD</td> </tr> <tr> <td></td> <td><u>V_n</u></td> <td>3x 230V ac 50/60Hz</td> </tr> <tr> <td></td> <td>In</td> <td>60A</td> </tr> <tr> <td></td> <td>Current balancing capacity</td> <td>50A</td> </tr> <tr> <td></td> <td>Fuse</td> <td>35A / 500V / <u>gG</u> 000</td> </tr> <tr> <td></td> <td>Network</td> <td>TN/TT</td> </tr> <tr> <td></td> <td>Casing</td> <td>IP55</td> </tr> <tr> <td></td> <td>Mass</td> <td>125kg</td> </tr> <tr> <td></td> <td>Serial no</td> <td>yyyy-mm-0000 [CE]</td> </tr> <tr> <td></td> <td>Made in</td> <td>EU</td> </tr> <tr> <td></td> <td colspan="2">Ensto Finland Oy</td> </tr> <tr> <td></td> <td colspan="2">P.O.Box 77</td> </tr> <tr> <td></td> <td colspan="2">06101 Porvoo</td> </tr> <tr> <td></td> <td colspan="2">Finland</td> </tr> <tr> <td></td> <td colspan="2">www.ensto.com</td> </tr> </table> </div>			Ensto	Finland		Phase	Balancer		Type	PB50A-3P-200STD		<u>V_n</u>	3x 230V ac 50/60Hz		In	60A		Current balancing capacity	50A		Fuse	35A / 500V / <u>gG</u> 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	
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Test item particulars.....:	Phase balancer
Classification of installation and use.....:	-
Supply Connection.....:	-
.....:	
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	10.4.2017
Date (s) of performance of tests	10.4-12.4.2017
General remarks:	
<p>The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</p> <p>Note TRF originator: Due to the different methods for design verification, it is left open if the tables at the end of the TRF are used or if separate reports are created for the test results. To prove compliance, the essential data shall be provided.</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: (a) the results shown in this document refer only to the sample(s) tested and (b) such sample(s) are retained for 3 months. This document cannot be reproduced except in full, without prior approval of the company.</i></p>	

Manufacturer's Declaration per sub-clause 6.2.5 of IEC 60076-2:

The application for obtaining a CB Test Certificate ☐ Yes
includes more than one factory location and a declaration from the Manufacturer stating that the ☒ Not applicable
sample(s) submitted for evaluation is (are)
representative of the products from each factory
has been provided

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

Name and address of factory (ies) : Ensto Finland Oy
P.O.Box 77
06101 Porvoo
Finland

General product information:

Phase balancer corrects imbalances in a three phase low voltage grid. It reduces flickering of electricity and harmonizes and increases the short circuit current in the line.

Models:

PB50A-3P-200STD EU-model
PB50A-3P-200ADV EU-model with electronic
PB50A-3P-300STD RUS/CIS-model
PB50A-3P-300ADV RUS/CIS-model with electronic

ADV model including:

- Grid state monitoring
- Overload protection (hardware/software)
- Operation indicators
- RS232 for remote control application (MODBUS RTU)

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
5	INTERFACE CHARACTERISTICS		
5.2	Voltage ratings		
	Rated voltage (U_n) (of the ASSEMBLY)	440 VAC	-
	Rated operational voltage (U_e) (of a circuit of an ASSEMBLY)	-	-
	Rated insulation voltage (U_i) (of a circuit of an ASSEMBLY)	440 VAC	P
	Rated impulse withstand voltage (U_{imp}) (of the ASSEMBLY)	6 kV	P
5.3	Current ratings		
	Rated current of the ASSEMBLY (I_{nA})	-	-
	Rated current of a circuit (I_{nc})	-	-
	Rated peak withstand current (I_{pk})	-	N/A
	Rated short-time withstand current (I_{cw}) (of a circuit of an ASSEMBLY)	-	N/A
	Rated conditional short-circuit current of an ASSEMBLY (I_{cc})	-	N/A
5.4	Rated diversity factor (RDF)		
5.5	Rated frequency (fn)		
5.6	Other characteristics		
	additional requirements depending on the specific service conditions of a functional unit (e.g. type of coordination, overload characteristics);		-
	pollution degree	3	-
	types of system earthing for which the ASSEMBLY is designed	-	N/A
	indoor and/or outdoor installation	Outdoor	P
	stationary or movable	Stationary	P
	degree of protection	IP55	P
	intended for use by skilled or ordinary persons	Skilled	P
	electromagnetic compatibility (EMC) classification		N/A
	special service conditions, if applicable		N/A
	external design	Box	P
	mechanical impact protection, if applicable		N/A
	the type of construction - fixed, removable or withdrawable parts		N/A
	the nature of short-circuit protective device(s)		N/A
	measures for protection against electric shock	min. IPXXB	P
	overall dimensions (including projections e.g handles, covers, doors)		N/A
	the weight		N/A

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
6	INFORMATION		N/A
7	SERVICE CONDITIONS		N/A
8	CONSTRUCTIONAL REQUIREMENTS		
8.1	Strength of materials and parts		N/A
8.2	Degree of protection provided by an ASSEMBLY enclosure		N/A
8.2.2	Protection against contact with live parts, ingress of solid foreign bodies and liquids		N/A
8.3	Clearances and creepage distances		
	The requirements for clearances and creepage distances are based on the principles of IEC 60664-1 and are intended to provide insulation co-ordination within the installation.		P
	The clearances and creepage distances of equipment that form part of the ASSEMBLY comply with the requirements of the relevant product standard.	Not investigated	N/A
	When incorporating equipment into the ASSEMBLY, the specified clearances and creepage distances are maintained during normal service conditions.		P
	For dimensioning clearances and creepage distances between separate circuits, the highest voltage ratings is used (rated impulse withstand voltage for clearances and rated insulation voltage for creepage distances).		P
	The clearances and creepage distances apply to phase to phase, phase to neutral, and except where a conductor is connected directly to earth, phase to earth and neutral to earth.		P
	For bare live conductors and terminations (e.g. busbars, connections between equipment and cable lugs), the clearances and creepage distances are at least equivalent to those specified for the equipment with which they are directly associated.		N/A
	The effect of a short-circuit up to and including the declared rating(s) of the ASSEMBLY does not reduce permanently the clearances or creepage distances between busbars and/or connections, below the values specified for the ASSEMBLY. Deformation of parts of the enclosure or of the internal partitions, barriers and obstacles due to a short-circuit do not reduce permanently the clearances or creepage distances below those specified in 8.3.2 and 8.3.3 (see also 10.11.5.5).		P
8.3.2	Clearances		
	The clearances are sufficient to enable the declared rated impulse withstand voltage (U_{imp}) of a circuit to be achieved. The clearances is as specified in Table 1 unless a design verification test and routine impulse withstand voltage test is carried out in accordance with 10.9.3 and 11.3, respectively.		P
8.3.3	Creepage distances		

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The original manufacturer selects a rated insulation voltage(s) (U_i) for the circuits of the ASSEMBLY from which the creepage distance(s) are determined. For any given circuit the rated insulation voltage is not less than the rated operational voltage (U_e).		P
	The creepage distances are not less than the associated minimum clearances.		P
8.4	Protection against electric shock		N/A
8.5	Incorporation of switching devices and components		N/A
8.6	Internal electrical circuits and connections		N/A
9	PERFORMANCE REQUIREMENTS		
9.1	Dielectric properties		
9.1.2	Power-frequency withstand voltage		
	The circuits of the ASSEMBLY are capable of withstanding the appropriate power frequency withstand voltages given in Tables 8 and 9. The rated insulation voltage of any circuit of the ASSEMBLY is equal to or higher than its maximum operational voltage.		P
9.1.3	Impulse withstand voltage		
9.1.3.1	Impulse withstand voltages of main circuits		
	Clearances from live parts to parts intended to be earthed and between poles are capable of withstanding the test voltage given in Table 10 appropriate to the rated impulse withstand voltage.	6 kV	P
	The rated impulse withstand voltage for a given rated operational voltage is not be less than that corresponding in Annex G to the nominal voltage of the supply system of the circuit at the point where the ASSEMBLY is to be used and the appropriate overvoltage category.	III	P
9.1.3.2	Impulse withstand voltages of auxiliary circuits		
	a) Auxiliary circuits that are connected to the main circuit and operate at the rated operational voltage without any means for reduction of overvoltage comply with the requirements of 9.1.3.1.		N/A
	b) Auxiliary circuits that are not connected to the main circuit may have an overvoltage withstand capacity different from that of the main circuit. The clearances of such circuits – a.c. or d.c. – are capable of withstanding the appropriate impulse withstand voltage in accordance with Annex G.		N/A
9.1.4	Protection of surge protective devices		N/A
9.2	Temperature rise limits		N/A
9.3	Short-circuit protection and short-circuit withstand strength		N/A
9.4	Electromagnetic compatibility (EMC)		N/A

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
10	DESIGN VERIFICATION		
	Design verification is intended to verify compliance of the design of an ASSEMBLY or ASSEMBLY system with the requirements of this series of standards.		-
	Where tests on the ASSEMBLY have been conducted in accordance with the IEC 60439 series, prior to the publication of the relevant product standard in the IEC 61439 series, and the test results fulfil the requirements of the relevant part of IEC 61439, the verification of these requirements need not be repeated.		N/A
	Repetition of verifications in the product standards of switching devices or components incorporated in the ASSEMBLY, which have been selected in accordance with 8.5.3 and installed in accordance with the instructions of their manufacturer is not required.		N/A
	Tests on individual devices to their respective product standards are not an alternative to the design verifications in this standard for the ASSEMBLY.		-
	Modifications on a verified ASSEMBLY have been checked with Clause 10 and do not affect the performance of the ASSEMBLY.		N/A
	The tests are performed on a representative sample of an ASSEMBLY in a clean and new condition		P
	The performance of the ASSEMBLY may be affected by the verification tests (e.g. short-circuit test). These tests are not performed on an ASSEMBLY that is intended to be placed in service.		-
	An ASSEMBLY which is verified in accordance with this standard by an original manufacturer (see 3.10.1) and manufactured or assembled by another does not require the original design verifications to be repeated if all the requirements and instructions specified and provided by the Original Manufacturer are met in full.		N/A
	Where the ASSEMBLY manufacturer incorporates their own arrangements not included in the original manufacturer's verification, the ASSEMBLY manufacturer is deemed to be the original manufacturer in respect of these arrangements.		N/A
	The number of ASSEMBLIES or parts thereof used for verification and the order in which the verification is carried out is at the discretion of the original manufacturer.		N/A
	The data used, calculations made and comparison undertaken for the verification of ASSEMBLIES are recorded in a verification report.		N/A
10.2	STRENGTH OF MATERIALS AND PARTS		N/A
10.3	DEGREE OF PROTECTION OF PCS-ASSEMBLIES		N/A
10.4	CLEARANCES AND CREEPAGE DISTANCES		

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The clearances are sufficient to enable the declared rated impulse withstand voltage (U_{imp}) of a circuit to be achieved. Rated impulse withstands voltage. :	6 kV	P
	Required clearances as specified in Table 1. :	5,5 mm	P
	Measured clearances :	Over 12 mm. Printed circuit board and transformer are not included to this measurement	P
	The original manufacturer selects a rated insulation voltage(s) (U_i) for the circuits of the ASSEMBLY from which the creepage distance(s) is determined. For any given circuit the rated insulation voltage is not less than the rated operational voltage (U_e). Insulation voltage U_i :	400 VAC	P
	Pollution degree. :	3	P
	Material group :	II (connector housings)	P
	Minimum clearances required :	5,6 mm	P
	The creepage distances measured..... :	Over 12 mm. Printed circuit board and transformer are not included to this measurement	P
	Where functional units are mounted on withdrawable parts, the isolation provided in the isolated position is at least comply with the requirements in the relevant specification for disconnectors (see IEC 60947-3).		N/A
	The isolating distance between the withdrawable unit main contacts and their associated fixed contacts in the isolated position is capable of withstanding the test voltage for the declared impulse withstand voltage as specified in Table 102.		N/A
10.5	PROTECTION AGAINST ELECTRIC SHOCK AND INTEGRITY OF PROTECTIVE CIRCUITS		N/A
10.6	INCORPORATION OF SWITCHING DEVICES AND COMPONENTS		N/A
10.7	INTERNAL ELECTRICAL CIRCUITS AND CONNECTIONS		
10.8	TERMINALS FOR EXTERNAL CONDUCTORS		
10.9	DIELECTRIC PROPERTIES		
10.9.1	General		
	For this test, all the electrical equipment of the ASSEMBLY is connected, except those items of apparatus which, according to the relevant specifications, are designed for a lower test voltage; current-consuming apparatus (e.g. windings, measuring instruments, voltage surge suppression devices) in which the application of the test voltage would cause the flow of a current, are disconnected.		P

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Such apparatus are disconnected at one of their terminals unless they are not designed to withstand the full test voltage, in which case all terminals may be disconnected.		N/A
10.9.2	Power-frequency withstand voltage		
10.9.2.1	Main, auxiliary and control circuits		
	Main, auxiliary and control circuits that are connected to the main circuit are subjected to the test voltage according to Table 8.		P
	Auxiliary and control circuits, whether a.c. or d.c., that are not connected to the main circuit are subjected to the test voltage according to Table 9.		N/A
10.9.2.2	Test voltage		
	The test voltage has a practically sinusoidal waveform and a frequency between 45 Hz and 65 Hz.		P
	The high-voltage transformer used for the test is so designed that, when the output terminals are short-circuited after the output voltage has been adjusted to the appropriate test voltage, the output current is at least 200 mA.		P
	The overcurrent relay does not trip when the output current is less than 100 mA.		P
	The value of the test voltage is that specified in Table 8 or 9 as appropriate with a permitted tolerance of $\pm 3\%$.		P
10.9.2.3	Application of the test voltage		
	The power frequency voltage at the moment of application does not exceed 50 % of the full test value. It is then be increased progressively to this full value and maintained for 5 s as follows:		P
	a) between all live parts of the main circuit connected together (including the control and auxiliary circuits connected to the main circuit) and exposed conductive parts, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link		P
	b) between each live part of different potential of the main circuit and, the other live parts of different potential and exposed conductive parts connected together, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link;		P
	c) between each control and auxiliary circuit not normally connected to the main circuit and the – main circuit; – other circuits; – exposed conductive parts including the earthed enclosure		N/A
	The overcurrent relay does not operate and there are no disruptive discharge (see 3.6.18) during the tests.		P
10.9.3	Impulse withstand voltage		

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
10.9.3.1	General		-
	Verification shall be made by test or by assessment	Test and assessment. Clearances well over 1,5 times required	P
	In place of the impulse withstand voltage test the original manufacturer may perform, at his discretion, an equivalent a.c. or d.c. voltage test, in accordance with 10.9.3.3 or 10.9.3.4, but consideration is given to the fact that such a tests exert a higher stress.		P
10.9.3.2	Impulse withstand voltage test		
	The impulse voltage generator is adjusted to the required impulse voltage with the ASSEMBLY connected. The value of the test voltage is that specified in 9.1.3. The accuracy of the applied peak voltage is $\square\square 3\%$.		P
	Impulse withstand voltage (U_{imp}) :	Test voltage 7,3 kV	P
	Auxiliary circuits not connected to main circuits are connected to earth.		N/A
	The 1,2/50 μ s impulse voltage is applied to the ASSEMBLY five times for each polarity at intervals of 1 s minimum as follows:		P
	a) between all live parts of the main circuit connected together (including the control and auxiliary circuits connected to the main circuit) and exposed conductive parts, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link		P
	b) between each live part of different potential of the main circuit and, the other live parts of different potential and exposed conductive parts connected together, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link;		N/A
	For an acceptable result there are no unintentional disruptive discharge during the tests.		P
	The impulse withstand voltage capability of the isolating distance between the withdrawable units' main contacts and their associated fixed contacts are verified to confirm compliance with 8.3.2.		N/A
10.9.3.3	Alternative power-frequency voltage test		N/A
10.9.3.5	Verification assessment		
	Clearances are verified by measurement, or verification of measurements on design drawings, employing the measurement methods stated in Annex F.		P
	The clearances are at least 1,5 times the values specified in Table 1.	Clearances well over 1,5 times required	P
	It is verified by assessment of the device manufacturer's data that all incorporated devices are suitable for the specified rated impulse withstand voltage (U_{imp}).		P
10.9.4	Testing of enclosures made of insulating material		N/A
10.10	VERIFICATION OF TEMPERATURE RISE		N/A

IEC 61439-2			
Clause	Requirement + Test	Result - Remark	Verdict
10.11	SHORT-CIRCUIT WITHSTAND STRENGTH		N/A
10.12	ELECTROMAGNETIC COMPATIBILITY (EMC)		N/A
10.13	MECHANICAL OPERATION		N/A
	ANNEX J: ELECTROMAGNETIC COMPATIBILITY (EMC)		N/A
	ANNEX K: PROTECTION BY ELECTRICAL SEPARATION		N/A