ASSOCIATION OF POLISH ELECTRICIANS
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Since 1933 r.

TESTING LABORATORY

AB 044

TEST REPORT

IEC/EN 61439-5

Low-voltage switchgear and controlgear assemblies -
Part 5: Assemblies for power distribution in public networks

Report reference No.....:	LA-21.124/21.052/2/E
Date of issue .....:	2022-01-13
Total number of page ...:	68

Tested by (name + function + signature) ...:	Zbigniew Ostrowski Senior Specialist
Authorizing by (name + function + signature) ...:	Dariusz Szczepanowski Manager of LA Laboratory

Testing application number .....:	C-A-21-124/21.052	
Test items reference .....:	S-A-21-052	
Scope of test .....:	☐ - type test	☒ - partial test

Test specification:

Standard/procedure .....:	☒ PN-EN 61439-5:2015-02, in conjunction with: ☒ PN-EN 61439-1:2011, ☒ EN 61439-5:2015, ☒ EN 61439-1:2011, ☒ IEC 61439-5:2014 ☒ IEC 61439-1:2011
Non-standard	N/A
Non-accredited test method .....:	N/A

Applicant's name .....:	Zakład Usługowo-Produkcyjny EMITER Sp. j. Stanisław Bieda - Piotr Lis
Address .....:	34-600 Limanowa, ul. Skrudlak 3
Test item description .....:	The enclosures for low-voltage switchgear and controlgear assemblies made of thermosetting insulating material
Trade Mark .....:	emiter

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Date: 2023.05.18 14:40:02 EEST
Reason: MoldSign Signature
Location: Moldova

Manufacturer ……..……..……..……:	Zakład Usługowo-Produkcyjny EMITER Sp. j. Stanisław Bieda - Piotr Lis 34-600 Limanowa, ul. Skrudlak 3
Model/Type reference ..……:	OS …, OSZ …, OSi …, OSZi …
Rating(s) ....:	IP44(OS)/IP54(OSZ), Ui = 690 V, IK10. Dimension (L x H x D): 1948 mm x 396 mm x 248 mm (OSZ 40 x 80 SK + FMW-40), 1125 mm x 396 mm x 245 mm (FMW-40), 1199 mm x 396 mm x 245 mm (FWN-106).

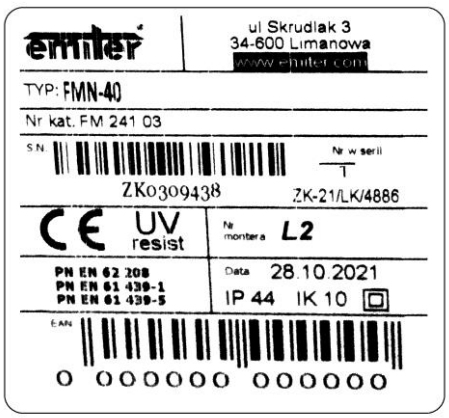
List of Attachments:

Attachment	Name of Attachments	Page number
No. 1	Summary of the test results	2
No. 2	List of test equipment used	2
No. 3	Photos of tested samples	3
No. 4	The test report No. LA-21.124/21.052/1/E according to PN-EN 62208: 2011 for type enclosures OS …, OSZ …, OSi …, OSZi …, issued by the SEP-BBJ in Lublin on 2022-01-13	19
No. 5	The test report No. LA-18.145/18.057/2 according to PN-EN 61439-5:2015-02 in conjunction with PN-EN 61439-1:2011 - for type enclosures OS …, OSZ …, OSi …, OSZi …, issued by the SEP-BBJ in Lublin on 2019-09-25	66

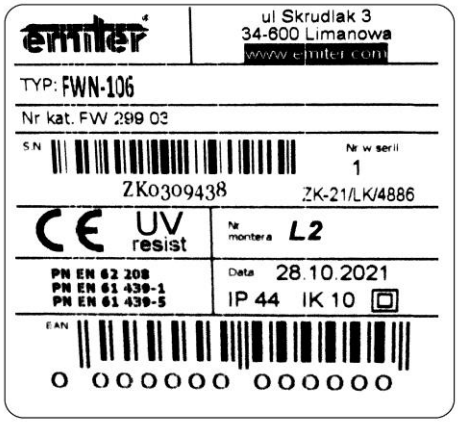
Summary of testing:

Testing performed (in the case of partial tests): see Attachment No.1	**Testing location:/address** (if different from page 1) BBJ-SEP TESTING LABORATORY 20-150 Lublin, ul. M. Rapackiego 13, POLAND
Number of tests with F (Fail) verdict	0
Summary conformity/non-conformity with standardization document (if apply)	N/A
Summary of compliance with National Differences (if apply): —	N/A
Opinions and interpretation, if needed:	N/A
Other additional information (as requested by the applicant): —	N/A

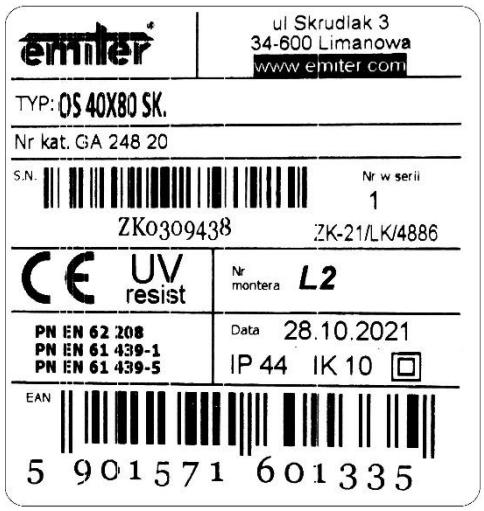
Copy of marking plates:



Foundation type: FMN-40 with enclosure type OS 40 x 80 SK - product object No.1



Foundation type: FWN-106 – product object No. 2



Enclosure type OS 40 x 80 SK with foundation type FMN - 40 for low voltage switchgears made of thermosetting insulation material - product object No.1 and foundation made of thermosetting insulation material type FWN -106 - product object No. 2

Test item particulars:
The tests were carried out on one enclosure with a foundation made of thermosetting insulating material marked with the number S-A-21-052 / 1 and on a foundation made of thermosetting insulating material marked with number S-A-21-052/ 2. In the further part of the report, abbreviated numbering of the product object marking was adopted as No. 1 and No. 2.

Enclosure type + foundation / or foundation	Product object number
OS 40 x 80 SK, without equipment + foundation FMW-40,	1
foundation FWN-106, without equipment,	2

External design	enclosed
Place of installation	outdoor - for installation at ground level on a foundation
Service conditions	normal
Mobility	stationary on the base
IP Code	IP44(OS …)/IP54 (OSZ …, FMW-40, FWN-106)
IK Code	IK10
Measures against electric shock	class II
Date(s) of receipt of test item .....……..:	2021-10-29
Data of test beginning ……..……..:	2021-12-28
Date(s) of performance of tests .....:	2022-01-13

Possible test case verdicts:

Test case does not apply to the test object .....: N/A

Test item does meet the requirement .....: P(Pass)

Test item does not meet the requirement .....: F(Fail)

Test report general remarks:

1. The test results presented in this report relate only to the object tested.
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2. "(See Enclosure #)" refers to additional information appended to the report.

3. "(See appended table)" refers to a table appended to the report.

4. Throughout this report a comma is used as the decimal separator.

5. Test Report Form is based on TRF No.: N/A

Production place(s) .....:	Zakład Usługowo-Produkcyjny EMITER Sp. j. Stanisław Bieda - Piotr Lis 34-600 Limanowa, ul. Skrudlak 3

General product information:
The tested enclosure and foundations are intended for use as parts of switchgears in accordance with the standards of the EN 61439 series. Electrical equipment can be installed either inside the enclosure on the rear wall in the mounting sockets provided for this purpose, on the mounting strip or on the mounting plate. Foundation elements are made of glass-fiber reinforced polyester with a hardener.

The tested foundations with enclosures can be used for the construction of switchgears in protection class II.

The enclosure and foundations were selected for testing as representatives of all types of enclosures, presented in the manufacturer's technical documentation ("Enclosures " catalogue) and in Table 1 presented in the report No. LA-21.124/21.052/1/E

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Clause	Requirement + Test	Result - Remark	Verdict

5	**INTERFACE CHARACTERISTICS**		P
5.2	**Voltage ratings**		P
5.2.1	Rated voltage (U_n) (of the ASSEMBLY) ..... :		N/A
5.2.2	Rated operational voltage (U_e) ..... : (of a circuit of an ASSEMBLY)		N/A
5.2.3	Rated insulation voltage (U_i) ..... : (of a circuit of an ASSEMBLY)	690 V - product object No. 1 and No. 2	P
5.2.4	Rated impulse withstand voltage (U_{imp}) ..... : (of the ASSEMBLY)		N/A
5.3	**Current ratings**		N/A
5.3.1	Rated current of the ASSEMBLY (I_{nA}) ..... :		N/A
5.3.2	Rated current of a circuit (I_{nc}) ..... :		N/A
5.3.3	Rated peak withstand current (I_{pk}) ..... :		N/A
5.3.4	Rated short-time withstand current (I_{cw}) ..... : (of a circuit of an ASSEMBLY)		N/A
5.3.5	Rated conditional short-circuit current of an ASSEMBLY (I_{cc}) ..... :		N/A
5.4	**Rated diversity factor (RDF)**		N/A
5.5	**Rated frequency (f_n)**		N/A
5.6	**Other characteristics**		N/A
	additional requirements depending on the specific service conditions of a functional unit (e.g. type of coordination, overload characteristics);		N/A
	pollution degree ..... :		N/A
	types of system earthing for which the ASSEMBLY is designed..... :		N/A
	indoor and/or outdoor installation ..... :	outdoor installation	P
	stationary or movable ..... :	stationary	P
	degree of protection ..... :	IP44 - product object No. 1 and No. 2	P
	intended for use by skilled or ordinary persons..... :		N/A
	electromagnetic compatibility (EMC) classification :		N/A
	special service conditions, if applicable ..... :		N/A
	external design ..... :	enclosed	P
	mechanical impact protection, if applicable ..... :	IK10 - product object No. 1 and No. 2	P
	the type of construction - fixed, removable or withdrawable parts ..... :	the type of construction - fixed	P
	the nature of short-circuit protective device(s) ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	measures for protection against electric shock ..... :	class II - product object No. 1 and No. 2	P
	overall dimensions (including projections e.g handles, covers, doors) ..... :	Dimension (L x H x D): 1948 mm x 396 mm x 248 mm (OSZ 40 x 80 SK + FMW-40), 1125 mm x 396 mm x 245 mm (FMW-40), 1199 mm x 396 mm x 245 mm (FWN-106).	P
	the weight..... :		N/A
6	**INFORMATION**		P
6.1	**ASSEMBLY designation marking**		P
	The following information regarding the ASSEMBLY is provided on the designation label(s):		—
	a) ASSEMBLY manufacturer's name or trade mark (see 3.10.2);	emiter	P
	b) type designation or identification number or any other means of identification, making it possible to obtain relevant information from the ASSEMBLY manufacturer;	– (OSZ 40 x 80 SK + FMW-40): product object No. 1; (FWN-106): product object No. 1	P
	c) means of identifying date of manufacture;	2021-10-28 – product object No. 1 and No. 2	P
	d) IEC 61439-5.	IEC 61439-5	P
6.2	**Documentation**		P
6.2.1	**Information relating to the ASSEMBLY**		—
	All interface characteristics according to Clause 5, where applicable, is provided in the technical documentation.		—
6.2.2	**Instructions for handling, installation, operation and maintenance**		P
	The ASSEMBLY manufacturer provides in documents or catalogues:		—
	the conditions, if any, for the handling, installation, operation and maintenance of the ASSEMBLY and the equipment contained therein.	product object No. 1 and No. 2	P
	the proper and correct transport, handling, installation and operation of the ASSEMBLY.		N/A
	The provision of weight details in connection with the transport and handling of ASSEMBLIES.		N/A
	The correct location and installation of lifting means and the thread size of lifting attachments, if applicable, is given in the ASSEMBLY manufacturer's documentation or the instructions on how the ASSEMBLY has to be handled.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The measures to be taken, if any, with regard to EMC associated with the installation, operation and maintenance of the ASSEMBLY is specified (see Annex J).		N/A
	If an ASSEMBLY specifically intended for environment A is to be used in environment B a warning is included in the operating instructions	no warning	N/A
	If the circuitry is not obvious from the physical arrangement of the apparatus installed, suitable information is supplied, for example wiring diagrams or tables.		N/A
6.3	**Device and/or component identification**		N/A
	Inside the ASSEMBLY, it is possible to identify individual circuits and their protective devices.		N/A
	Identification tags are legible, permanent and appropriate for the physical environment.		N/A
	Any designations used is in compliance with IEC 61346-1 and IEC 61346-2 and identical with those used in the wiring diagrams, which is in accordance with IEC 61082-1.		N/A
6.101	It is possible to identify each functional unit in a clearly visible manner		N/A
7	**SERVICE CONDITIONS**		P
7.1	**Normal service conditions**		N/A
7.1.1.1	**Ambient air temperature for indoor installations**		N/A
	The ambient air temperature does not exceed +40 °C and its average over a period of 24 h does not exceed +35 °C. The lower limit of the ambient air temperature is –5 °C.		N/A
7.1.1.2	**Ambient air temperature for outdoor installations**		N/A
	The ambient air temperature does not exceed +40 °C and its average over a period of 24 h does not exceed +35 °C. The lower limit of the ambient air temperature is –25 °C.		N/A
7.1.2.1	**Humidity conditions for indoor installations**		N/A
	The air is clean and its relative humidity does not exceed 50 % at a maximum temperature of +40 °C. Higher relative humidity may be permitted at lower temperatures, for example 90 % at +20 °C. Moderate condensation is taken care of, which may occasionally occur due to variations in temperature.		N/A
7.1.2.2	**Humidity conditions for outdoor installations**		P
	The relative humidity may temporarily be as high as 100 % at a maximum temperature of +25 °C.	+40 °C/35 °C, -25 °C	P
7.1.3	**Pollution degree**		P
	The pollution degree refers to the environmental conditions for which the ASSEMBLY is intended.	the pollution degree: 3	P

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Clause	Requirement + Test	Result - Remark	Verdict
7.1.4	**Altitude**		P
	The altitude of the site of installation does not exceed 2 000 m.		P
7.2	**Special service conditions**		P
	Where any special service conditions exist, the applicable particular requirements are met or special agreements are made between the ASSEMBLY manufacturer and the user.		P
	a) values of temperature, relative humidity and/or altitude differing from those specified in 7.1;	-50 °C	P
	b) applications where variations in temperature and/or air pressure take place at such a speed that exceptional condensation is liable to occur inside the ASSEMBLY;		P
	c) heavy pollution of the air by dust, smoke, corrosive or radioactive particles, vapours or salt;		N/A
	d) exposure to strong electric or magnetic fields;		N/A
	e) exposure to extreme climatic conditions;		N/A
	f) attack by fungus or small creatures;		N/A
	g) installation in locations where fire or explosion hazards exist;		N/A
	h) exposure to heavy vibration, shocks, seismic occurrences;		N/A
	i) installation in such a manner that the current-carrying capacity or breaking capacity is affected, for example equipment built into machines or recessed into walls;		N/A
	j) exposure to conducted and radiated disturbances other than electromagnetic, and electromagnetic disturbances in environments other than those described in 9.4;		N/A
	k) exceptional overvoltage conditions;		N/A
	l) excessive harmonics in the supply voltage or load currents.		N/A
7.3	**Conditions during transport, storage and installation**		P
	A special agreement is made between the ASSEMBLY manufacturer and the user if the conditions during transport, storage and installation, for example temperature and humidity conditions, differ from those defined in 7.1.	The same as those defined in cl. 7.1	P
8	**CONSTRUCTIONAL REQUIREMENTS**		P
8.1	**Strength of materials and parts**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	ASSEMBLIES are constructed of materials capable of withstanding the mechanical, electrical, thermal and environmental stresses that are likely to be encountered in specified service conditions.		P
8.1.2	**Protection against corrosion**		P
	Protection against corrosion is ensured by the use of suitable materials or by protective coatings to the exposed surface, taking account of the intended normal service conditions of use and maintenance.	product object No. 1 and No. 2	P
8.1.3	**Properties of insulating materials**		P
8.1.3.1	**Thermal stability**		P
	For enclosures or parts of enclosures made of insulating materials, thermal stability is verified according to 10.2.3.1.	product object No. 1 and No. 2	P
8.1.3.2	**Resistance of insulating materials to heat and fire**		P
8.1.3.2.2	**Resistance of insulating materials to heat**		P
	The original manufacturer demonstrates compliance either by reference to the insulation temperature index (determined for example by the methods of IEC 60216) or by compliance with IEC 60085.	product object No. 1 and No. 2	P
8.1.3.2.3	**Resistance of insulating materials to abnormal heat and fire due to internal electric effects**		P
	Insulating materials used for parts necessary to retain current carrying parts in position and parts which might be exposed to thermal stresses due to internal electrical effects, and the deterioration of which might impair the safety of the ASSEMBLY, are not adversely affected by abnormal heat and fire and are verified by the glow-wire test in 10.2.3.2. For the purpose of this test, a protective conductor (PE) is not considered as a current-carrying part.	see Attachment No. 5	P
	For small parts (having surface dimensions not exceeding 14 mm x 14 mm), an alternative test may be used (e.g. needle flame test, according to IEC 60695-11-5). The same procedure may be applicable for other practical reasons where the metal material of a part is large compared to the insulating material.		N/A
8.1.3.2.101	**Verification of category of flammability**		P
	The insulating materials used for enclosures, barriers and other insulating parts have flame retardant properties in accordance with 10.2.3.102	see Attachment No. 5	P
8.1.4	**Resistance to ultra-violet radiation**		P
	For enclosures and external parts made of insulating materials which are intended to be used outdoor, resistance to ultra-violet radiation is verified according to 10.2.4.	see Attachment No. 5	P
8.1.5	**Mechanical strength**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	All enclosures or partitions including locking means and hinges for doors are of a mechanical strength sufficient to withstand the stresses to which they may be subjected in normal service, and during short-circuit conditions (see also 10.13).	see Attachment No. 5	P
	The mechanical operation of removable parts, including any insertion interlock, is verified by test according to 10.13.		N/A
8.1.5.101	**Verification of mechanical strength**		P
	Mechanical properties of a PENDA-O comply with 10.2.101	PENDA-O	P
	Parts of the PENDA-O intended to be embedded in the ground withstand the stresses imposed on them during installation and normal service and comply with 10.2.101.9.		P
8.1.6	**Lifting provision**		N/A
	Where required, ASSEMBLIES are provided with the appropriate provision for lifting. Compliance is checked according to the test of 10.2.5.		N/A
8.1.101	**Thermal stability**		P
	The thermal stability of a PENDA verified according to 10.2.3.101	see Attachment No. 5	P
8.2	**Degree of protection provided by an ASSEMBLY enclosure**		P
8.2.1	**Protection against mechanical impact**		P
	The degree of protection provided by an ASSEMBLY enclosure against mechanical impact, if necessary, are defined by the relevant ASSEMBLY standards and verified in accordance with IEC 62262. (see 10.2.6).	IK10: see Attachment No. 4	P
8.2.2	**Protection against contact with live parts, ingress of solid foreign bodies and water**		P
	The degree of protection provided by any ASSEMBLY against contact with live parts, ingress of solid foreign bodies and water is indicated by the IP code according to IEC 60529 and verified according to 10.3	see Attachment No. 4	P
	The degree of protection of an enclosed ASSEMBLY is at least IP 2X, after installation in accordance with the ASSEMBLY manufacturer's instructions. The degree of protection provided from the front of a dead front ASSEMBLY is at least IP XXB.		N/A
	For ASSEMBLIES for outdoor use having no supplementary protection, the second characteristic numeral is at least 3.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Unless otherwise specified, the degree of protection indicated by the ASSEMBLY manufacturer applies to the complete ASSEMBLY when installed in accordance with the ASSEMBLY manufacturer's instructions, for example sealing of the open mounting surface of an ASSEMBLY, etc.		N/A
	Where the ASSEMBLY does not have the same IP rating throughout, the ASSEMBLY manufacturer shall declare the IP rating for separate parts.		N/A
	Enclosed ASSEMBLIES, for outdoor and indoor installation, intended for use in locations with high humidity and temperatures varying within wide limits, are provided with suitable arrangements (ventilation and/or internal heating, drain holes, etc.) to prevent harmful condensation within the ASSEMBLY. However, the specified degree of protection is the same time maintained.		N/A
8.2.3	**ASSEMBLY with removable parts**		N/A
	The degree of protection indicated for ASSEMBLIES normally applies to the connected position (see 3.2.3) of removable parts.		N/A
	If, after the removal of a removable part, the original degree of protection is not maintained, an agreement is made between the ASSEMBLY manufacturer and the user as to what measures are taken to ensure adequate protection. Information provided by the ASSEMBLY manufacturer may take the place of such an agreement.		N/A
8.3	**Clearances and creepage distances**		P
	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.	see Attachment No. 5	P
	The clearances and creepage distances of equipment that form part of the ASSEMBLY comply with the requirements of the relevant product standard.		N/A
	When incorporating equipment into the ASSEMBLY, the specified clearances and creepage distances are maintained during normal service conditions.		N/A
	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).		N/A
	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.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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).		N/A
8.3.2	**Clearances**		N/A
	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.		N/A
8.3.3	**Creepage distances**		P
	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).		N/A
	The creepage distances are not less than the associated minimum clearances.		N/A
	Creepage distances are correspond to a pollution degree as specified in 7.1.3 and to the corresponding material group at the rated insulation voltage given in Table 2.		N/A
8.4	**Protection against electric shock**		P
8.4.2	**Basic protection**		P
8.4.2.1	**General**		P
	Basic protection can be achieved either by appropriate constructional measures on the ASSEMBLY itself or by additional measures to be taken during installation; this may require information to be given by the ASSEMBLY manufacturer.	see Attachment No. 5	P
	Where basic protection is achieved by constructional measures one or more of the protective measures given in 8.4.2.2 and 8.4.2.3 may be selected.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The choice of the protective measure is declared by the ASSEMBLY manufacturer if not specified within the relevant ASSEMBLY standard.		N/A
8.4.2.2	**Basic insulation provided by insulating material**		P
	Hazardous live parts are completely covered with insulation that can only be removed by destruction.	see Attachment No. 5	P
	The insulation is made of suitable materials capable of durably withstanding the mechanical, electrical and thermal stresses to which the insulation may be subjected in service.		N/A
	Paints, varnishes and lacquers alone are not considered to satisfy the requirements for basic insulation.		N/A
8.4.2.3	**Barriers or enclosures**		P
	Air insulated live parts are inside enclosures or behind barriers providing at least a degree of protection of IP XXB	enclosure of insulating material: degree of protection IP44; product object No. 1	P
	Horizontal top surfaces of accessible enclosures having a height equal to or lower than 1,6 m above the standing area, provide a degree of protection of at least IP XXD.	height enclosures: 1948 mm – 525 mm = 1,423 m; IP44	P
	Barriers and enclosures are firmly secured in place and have sufficient stability and durability to maintain the required degrees of protection and appropriate separation from live parts under normal service conditions, taking account of relevant external influences. The distance between a conductive barrier or enclosure and the live parts they protect is not less than the values specified for the clearances and creepage distances in 8.3.	enclosures are well secured in place and have sufficient stability and strength to maintain the required levels of protection and separation of live parts under normal operating conditions, taking into account the external effects of internal connections	P
	Where it is necessary to remove barriers or open enclosures or to remove parts of enclosures, this is possible only if one of the conditions a) to c) is fulfilled:		P
	a) By the use of a key or tool, i.e. any mechanical aid, to open the door, cover or override an interlock.	by use of a key to open the door	P
	b) After isolation of the supply to live parts, against which the barriers or enclosures afford basic protection, restoration of the supply being possible only after replacement or reclosure of the barriers or enclosures. In TN-C systems, the PEN conductor is not be isolated or switched. In TN-S systems and TN-C-S systems the neutral conductors need not be isolated or switched (see IEC 60364-5-53, 536.1.2).		P
	c) Where an intermediate barrier providing a degree of protection of at least IP XXB prevents contact with live parts, such a barrier being removable only by the use of a key or tool.		P
8.4.2.101	**Earthing and short-circuiting means**		N/A

PN-EN 61439-5			
Clause	Requirement + Test	Result - Remark	Verdict
	The outgoing units in an ASSEMBLY shall be so constructed that they can be earthed and short-circuited in a secure manner by means of a device(s) recommended by the manufacturer, which ensures the manufacturer's indicated degree of protection (IP code) is maintained for all parts of the ASSEMBLY.		N/A
	This requirement is not applicable if it could cause a safety hazard arising from the system conditions and/or operational practice.		N/A
8.4.3	**Fault protection**		P
8.4.3.1	**Installation conditions**		P
	The ASSEMBLY includes protective measures and is suitable for installations designed to be in accordance with IEC 60364-4-41.	in accordance with IEC 60364-4-41: see Attachment No. 5	P
	Protective measures suitable for particular installations (e.g. railways, ships) are subject to agreement between the ASSEMBLY manufacturer and the user.		N/A
8.4.3.2	**Requirements for the protective conductor to facilitate automatic disconnection of the supply**		N/A
8.4.3.2.1	**General**		N/A
	Each ASSEMBLY has a protective conductor to facilitate automatic disconnection of the supply for:		N/A
	a) protection against the consequences of faults (e.g. failure of basic insulation) within the ASSEMBLY;		N/A
	b) protection against the consequences of faults (e.g. failure of basic insulation) in external circuits supplied through the ASSEMBLY.		N/A
8.4.3.2.2	**Requirements for earth continuity providing protection against the consequences of faults within the ASSEMBLY**		N/A
	All exposed conductive parts of the ASSEMBLY are interconnected together and to the protective conductor of the supply or via an earthing conductor to the earthing arrangement.		N/A
	These interconnections may be achieved either by metal screwed connections, welding or other conductive connections or by a separate protective conductor. In the case of a separate protective conductor Table 3 is used.		N/A
	For the continuity of these connections the following is applied:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	a) When a part of the ASSEMBLY is removed, for example for routine maintenance, the protective circuits (earth continuity) for the remainder of the ASSEMBLY is not interrupted. Means used for assembling the various metal parts of an ASSEMBLY are considered sufficient for ensuring continuity of the protective circuits if the precautions taken guarantee permanent good conductivity.		N/A
	Flexible or pliable metal conduits are not used as protective conductors unless they are designed for that purpose.		N/A
	b) For lids, doors, cover plates and the like, the usual metal screwed connections and metal hinges are considered sufficient to ensure continuity provided that no electrical equipment exceeding the limits of extra low voltage (ELV) is attached to them.		N/A
	If apparatus with a voltage exceeding the limits of extra-low voltage are attached to lids, doors, or cover plates additional measures are taken to ensure earth continuity. These parts are fitted with a protective conductor (PE) whose cross-sectional area is in accordance with Table 3 depending on the highest rated operational current I_e of the apparatus attached or, if the rated operational current of the attached apparatus is less than or equal to 16 A, an equivalent electrical connection especially designed and verified for this purpose (sliding contact, hinges protected against corrosion).		N/A
	Exposed conductive parts of a device that cannot be connected to the protective circuit by the fixing means of the device are connected to the protective circuit of the ASSEMBLY by a conductor whose cross-sectional area is chosen according to Table 3.		N/A
	Certain exposed conductive parts of an ASSEMBLY that do not constitute a danger –either because they cannot be touched on large surfaces or grasped with the hand, – or because they are of small size (approximately 50 mm by 50 mm) or so located as to exclude any contact with live parts, need not be connected to a protective conductor. This applies to screws, rivets and nameplates. It also applies to electromagnets of contactors or relays, magnetic cores of transformers, certain parts of releases, or similar, irrespective of their size.		N/A
	When removable parts are equipped with a metal supporting surface, these surfaces are considered sufficient for ensuring earth continuity of protective circuits provided that the pressure exerted on them is sufficiently high.		NA
8.4.3.2.3	**Requirements for protective conductors providing protection against the consequences of faults in external circuits supplied through the ASSEMBLY**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	A protective conductor within the ASSEMBLY is so designed that it is capable of withstanding the highest thermal and dynamic stresses arising from faults in external circuits at the place of installation that are supplied through the ASSEMBLY. Conductive structural parts may be used as a protective conductor or a part of it.		N/A
	In principle, with the exception of the cases mentioned below, protective conductors within an ASSEMBLY does not include a disconnecting device (switch, disconnector, etc.):		N/A
	In the run of protective conductors links are permitted which are removable by means of a tool and accessible only to authorized personnel (these links may be required for certain tests).		N/A
	Where continuity can be interrupted by means of connectors or plug-and-socket devices, the protective circuit can be interrupted only after the live conductors have been interrupted and continuity is established before the live conductors are reconnected.		N/A
	In the case of an ASSEMBLY containing structural parts, frameworks, enclosures, etc., made of conducting material, a protective conductor, if provided, need not be insulated from these parts. Conductors to certain protective devices including the conductors connecting them to a separate earth electrode are insulated. This applies for instance to voltage-operated fault detection devices and can also apply to the earth connection of the transformer neutral.		N/A
	The cross-sectional area of protective conductors (PE, PEN) in an ASSEMBLY to which external conductors are intended to be connected are not less than the value calculated with the aid of the formula indicated in Annex B using the highest fault current and fault duration that may occur and taking into account the limitation of the short-circuit protective devices (SCPDs) that protect the corresponding live conductors. The short-circuit withstand strength is verified according to10.5.3.		N/A
	For PEN conductors, the following additional requirements apply:		N/A
	– the minimum cross-sectional area is 10 mm^2 copper or 16 mm^2 aluminium;		N/A
	– the PEN conductor has a cross-sectional area not less than that required for a neutral conductor (see 8.6.1);		N/A
	– the PEN conductors need not be insulated within an ASSEMBLY;		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– structural parts are not used as a PEN conductor. However, mounting rails made of copper or aluminium may be used as PEN conductors;		N/A
	For details of requirements for terminals for external protective conductor, see 8.8		N/A
8.4.3.3	**Electrical separation**		N/A
	Electrical separation of individual circuits is intended to prevent electrical shock through contact with exposed-conductive-parts, which may be energized by a fault in basic insulation of the circuit. For this type of protection, see Annex K.		N/A
8.4.4	**Protection by total insulation**		P
	For protection, by total insulation, against indirect contact the following requirements are met.		P
	a) The apparatus is completely enclosed in insulating material which is equivalent of double or reinforced insulation. The enclosure carries the symbol  which is visible from the outside.	the enclosure carries the symbol  which is visible from the outside: see Attachment No. 5	P
	b) The enclosure is at no point pierced by conducting parts in such a manner that there is the possibility of a fault voltage being brought out of the enclosure.		N/A
	This means that metal parts, such as actuator shafts which for constructional reasons have to be brought through the enclosure, are insulated on the inside or the outside of the enclosure from the live parts for the maximum rated insulation voltage and the maximum rated impulse withstand voltage of all circuits in the ASSEMBLY.		N/A
	If an actuator is made of metal (whether covered by insulating material or not), it is provided with insulation rated for the maximum rated insulation voltage and the maximum impulse withstand voltage of all circuits in the ASSEMBLY.		N/A
	If an actuator is principally made of insulating material, any of its metal parts which may become accessible in the event of insulation failure are also insulated from live parts for the maximum rated insulation voltage and the maximum rated impulse withstand voltage of all circuits in the ASSEMBLY.		N/A
	c) The enclosure, when the ASSEMBLY is ready for operation and connected to the supply, encloses all live parts, exposed conductive parts and parts belonging to a protective circuit in such a manner that they cannot be touched. The enclosure gives at least the degree of protection IP 2XC (see IEC 60529)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	If a protective conductor, which is extended to electrical equipment connected to the load side of the ASSEMBLY, is to be passed through an ASSEMBLY whose exposed conductive parts are insulated, the necessary terminals for connecting the external protective conductors are provided and identified by suitable marking.		N/A
	Inside the enclosure, the protective conductor and its terminal are insulated from the live parts and the exposed conductive parts in the same way as the live parts are insulated.		N/A
	d) Exposed conductive parts within the ASSEMBLY are not connected to the protective circuit, i.e. they are not included in a protective measure involving the use of a protective circuit. This applies also to built-in apparatus, even if they have a connecting terminal for a protective conductor.		N/A
	e) If doors or covers of the enclosure can be opened without the use of a key or tool, a barrier of insulating material is provided that will afford protection against unintentional contact not only with the accessible live parts, but also with the exposed conductive parts that are only accessible after the cover has been opened; this barrier, however, is not removable except with the use of a tool.		N/A
8.4.5	**Limitation of steady-state touch current and charge**		N/A
	If the ASSEMBLY contains items of equipment that may have steady-state touch current and charges after they have been switched off (capacitors, etc.) a warning plate is required.		N/A
	Small capacitors such as those used for arc extinction, for delaying the response of relays, etc., are not considered dangerous.		N/A
8.4.6	**Operating and servicing conditions**		P
8.4.6.1	**Devices to be operated or components to be replaced by ordinary persons**		N/A
	Protection against any contact with live parts is maintained when operating devices or when replacing components.		N/A
	Openings larger than those defined by degree of protection IP XXC are allowed during the replacement of certain lamps or fuse links.		N/A
8.4.6.2	**Requirements related to accessibility in service by authorized persons**		P
8.4.6.2.1	**General**		P
	For accessibility in service by authorized persons, one or more of the following requirements in 8.4.6.2.2 to 8.4.6.2.4 are fulfilled subject to agreement between the ASSEMBLY manufacturer and the user. These requirements are complementary to the basic protection specified in 8.4.2	see Attachment No. 5	P

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Clause	Requirement + Test	Result - Remark	Verdict
	If doors or cover of the ASSEMBLY can be opened by authorized persons by overriding an interlock to obtain access to live parts, then the interlock shall automatically be restored on reclosing the door(s) or replacing the cover(s);		N/A
8.4.6.2.2	**Requirements related to accessibility for inspection and similar operations**		N/A
	The ASSEMBLY is constructed in such a way that certain operations, according to agreement between the ASSEMBLY manufacturer and the user, can be performed when the ASSEMBLY is in service and under voltage.		N/A
	Such operations may consist of:		N/A
	– visual inspection of – switching devices and other apparatus, – settings and indicators of relays and releases, – conductor connections and marking;		N/A
	– adjusting and resetting of relays, releases and electronic devices;		N/A
	– replacement of fuse-links;		N/A
	– replacement of indicating lamps;		N/A
	– certain fault location operations, for example voltage and current measuring with suitably designed and insulated devices.		N/A
8.4.6.2.3	**Requirements related to accessibility for**		N/A
	To enable maintenance as agreed upon between the ASSEMBLY manufacturer and the user on an isolated functional unit or isolated group of functional units in the ASSEMBLY, with adjacent functional units or groups still under voltage, necessary measures are taken.		N/A
	The choice depends on such factors as service conditions, frequency of maintenance, competence of the authorized person, as well as local installation rules. Such measures may include:		N/A
	– sufficient space between the actual functional unit or group and adjacent functional units or groups. It is recommended that parts likely to be removed for maintenance have, as far as possible, retainable fastening means;		N/A
	– use of barriers or obstacles designed and arranged to protect against direct contact with equipment in adjacent functional units or groups;		N/A
	– use of terminal shields;		N/A
	– use of compartments for each functional unit or group;		N/A
	– insertion of additional protective means provided or specified by the ASSEMBLY manufacturer.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.4.6.2.4	**Requirements related to accessibility for extension under voltage**		N/A
	When it is required to enable future extension of an ASSEMBLY with additional functional units or groups, with the rest of the ASSEMBLY still under voltage, the requirements specified in 8.4.6.2.3 apply, subject to agreement between the ASSEMBLY manufacturer and the user.		N/A
	These requirements also apply for the insertion and connection of additional outgoing cables when the existing cables are under voltage.		N/A
	The extension of busbars and connection of additional units to their incoming supply are not made under voltage, unless the ASSEMBLY is designed for this purpose.		N/A
8.4.6.2.5	**Obstacles**		N/A
	Obstacles prevent either:		N/A
	– unintentional bodily approach to live parts, or		N/A
	– unintentional contact with live parts during the operation of live equipment in normal service.		N/A
	Obstacles may be removed without using a key or tool but are so secured as to prevent unintentional removal. The distance between a conductive obstacle and the live parts they protect is not less than the values specified for the clearances and creepage distances in 8.3.		N/A
	Where a conductive obstacle is separated from hazardous live parts by basic protection only, it is an exposed conductive part, and measures for fault protection are also applied.		N/A
8.5	**Incorporation of switching devices and components**		N/A
8.5.1	**Fixed parts**		N/A
	For fixed parts (see 3.2.1), the connections of the main circuits (see 3.1.3) is only connected or disconnected when the ASSEMBLY is not under voltage.		N/A
	Removal and installation of fixed parts requires the use of a tool.		N/A
	The disconnection of a fixed part requires the isolation of the complete ASSEMBLY or part of it.		N/A
	In order to prevent unauthorized operation, the switching device may be provided with means to secure it in one or more of its positions.		N/A
8.5.2	**Removable parts**		N/A
	The removable parts are so constructed that their electrical equipment can be safely isolated from or connected to the main circuit whilst this circuit is live.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The removable parts may be provided with an insertion interlock (see 3.2.5)		N/A
	Minimum clearances and creepage distances are complied with in the different positions as well as during transfer from one position to another.		N/A
8.5.2.101	**Withdrawable parts**		N/A
	Withdrawable parts have in addition an isolated position and may have a test position or a test situation		N/A
	Withdrawable parts are distinctly located in these positions. These positions are clearly discernible.		N/A
	In PSC-ASSEMBLIES with withdrawable parts all live parts are protected in such a manner that they cannot unintentionally be touched when the door, if any, is open and the withdrawable part is withdrawn from the connected position or removed.		N/A
	Where an obstacle or shutter is used they meet the requirements of 8.4.5.2.5 of Part 1, and warning labels are provided.		N/A
8.5.2.102	**Interlocking and padlocking of withdrawable parts**		N/A
	Unless otherwise specified, withdrawable parts are fitted with a device, which ensures that the apparatus can only be withdrawn and/or re-inserted after its main circuit has been interrupted.		N/A
	In order to prevent unauthorized operation, withdrawable parts may be provided with means for a padlock or lock to secure them in one or more of their positions.		N/A
8.5.3	**Selection of switching devices and components**		N/A
	Switching devices and components incorporated in ASSEMBLIES comply with the relevant IEC standards.		N/A
	The switching devices and components having a short-circuit withstand strength and/or a breaking capacity which is insufficient to withstand the stresses likely to occur at the place of installation, are protected by means of current-limiting protective devices, for example fuses or circuit-breakers.		N/A
	When selecting current-limiting protective devices for built-in switching devices, account is taken of the maximum permissible values specified by the device manufacturer, having due regard to co-ordination (see 9.3.4).		N/A
	Co-ordination of switching devices and components, for example co-ordination of motor starters with short-circuit protective devices, comply with the relevant IEC standards.		N/A
8.5.4	**Installation of switching devices and components**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Switching devices and components are installed and wired in the ASSEMBLY in accordance with instructions provided by their manufacturer and in such a manner that their proper functioning is not impaired by interaction, such as heat, switching emissions, vibrations, electromagnetic fields, which are present in normal operation.		N/A
	In the case of electronic assemblies, this may necessitate the separation or screening of all electronic signal processing circuits.		N/A
	When fuses are installed the original manufacturer states the type and rating of the fuse links to be used.		N/A
8.5.5	**Accessibility**		N/A
	Adjusting and resetting devices, which have to be operated inside the ASSEMBLY are easily accessible.		N/A
	Functional units mounted on the same support (mounting plate, mounting frame) and their terminals for external conductors are so arranged as to be accessible for mounting, wiring, maintenance and replacement.		N/A
	Unless otherwise agreed between the ASSEMBLY manufacturer and the user the following accessibility requirements associated with floor-mounted ASSEMBLIES apply:		N/A
	The terminals, excluding terminals for protective conductors, are situated at least 0,2 m above the base of the ASSEMBLIES and, moreover, be so placed that the cables can be easily connected to them.		N/A
	Indicating instruments that need to be read by the operator are located within a zone between 0,2 m and 2,2 m above the base of the ASSEMBLY.		N/A
	Operating devices such as handles, push buttons, or similar are located at such a height that they can easily be operated; this means that their centreline are located within a zone between 0,2 m and 2 m above the base of the ASSEMBLY.		N/A
	Actuators for emergency switching devices (see 536.4.2 of IEC 60364-5-53) are accessible within a zone between 0,8 m and 1,6 m above the base of the ASSEMBLY		N/A
8.5.6	**Barriers**		N/A
	Barriers for manual switching devices are so designed that the switching emissions do not present a danger to the operator.		N/A
	To minimize danger when replacing fuse-links, interphase barriers are applied, unless the design and location of the fuses makes this unnecessary.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.5.7	**Direction of operation and indication of switching positions**		N/A
	The operational positions of components and devices are clearly identified. If the direction of operation is not in accordance with IEC 60447, then the direction of operation is clearly identified.		N/A
8.5.8	**Indicator lights and push-buttons**		N/A
	Unless otherwise specified in the relevant product standard the colours of indicator lights and push-buttons are in accordance with IEC 60073.		N/A
8.6	**Internal electrical circuits and connections**		N/A
8.6.1	**Main circuits**		N/A
	The busbars (bare or insulated) are arranged in such a manner that an internal short-circuit is not to be expected.		N/A
	They are rated at least in accordance with the information concerning the short-circuit withstand strength (see 9.3) and designed to withstand at least the short-circuit stresses limited by the protective device(s) on the supply side of the busbars.		N/A
	Within one section, the conductors (including distribution busbars) between the main busbars and the supply side of functional units as well as the components included in these units may be rated on the basis of the reduced short-circuit stresses occurring on the load side of the respective short-circuit protective device within each unit, provided that these conductors are arranged so that under normal operation an internal short-circuit between phases and/or between phases and earth is not to be expected (see 8.6.4).		N/A
	Unless otherwise agreed between the ASSEMBLY manufacturer and the user, the minimum cross-sectional area of the neutral within a three phase and neutral circuit is:		N/A
	- For circuits with a phase conductor cross-sectional area up to and including 16 mm^2, 100 % of that of the corresponding phases.		N/A
	- For circuits with a phase conductor cross-sectional area above 16 mm^2, 50 % of that of the corresponding phases with a minimum of 16 mm^2.		N/A
	It is assumed that the neutral currents do not exceed 50 % of the phase currents.		N/A
	The PEN is dimensioned as specified in 8.4.3.2.3		N/A
8.6.2	**Auxiliary circuits**		N/A
	The design of the auxiliary circuits takes into account the supply earthing system and ensures that an earth-fault or a fault between a live part and an exposed conductive part does not cause unintentional dangerous operation.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	In general, auxiliary circuits are protected against the effects of short circuits.		N/A
	However, a short-circuit protective device is not provided if its operation is liable to cause a danger. In such a case, the conductors of auxiliary circuits are arranged in such a manner that a short-circuit is not to be expected (see 8.6.4).		N/A
8.6.3	**Bare and insulated conductors**		N/A
	The connections of current-carrying parts do not suffer undue alteration as a result of normal temperature rise, ageing of the insulating materials and vibrations occurring in normal operation.		N/A
	The effects of thermal expansion and of the electrolytic action in the case of dissimilar metals, and the effects of the endurance of the materials to the temperatures attained, are taken into consideration		N/A
	Connections between current-carrying parts are established by means that ensure a sufficient and durable contact pressure.		N/A
	If verification of temperature rise is carried out on the basis of tests (see 10.10.2) the selection of conductors and their cross-sections used inside the ASSEMBLY is the responsibility of the ASSEMBLY manufacturer.		N/A
	If verification of temperature rise is made following the rules of 10.10.3, the conductors have a minimum cross-section according to IEC 60364-5-52. Examples on how to adapt this standard for conditions inside an ASSEMBLY are given in the tables included in Annex H.		N/A
	In the case of insulated solid or flexible conductors:		N/A
	– They are rated for at least the rated insulation voltage (see 5.2.3) of the circuit concerned.		N/A
	– Conductors connecting two termination points have no intermediate joint, e.g. spliced or soldered.		N/A
	– Conductors with only basic insulation are prevented from coming into contact with bare live parts at different potentials.		N/A
	– Contact of conductors with sharp edges are prevented.		N/A
	- Supply conductors to apparatus and measuring instruments in covers or doors are so installed that no mechanical damage can occur to the conductors as a result of movement of these covers or doors.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– Soldered connections to apparatus are permitted in ASSEMBLIES only in cases where provision is made for this type of connection on the apparatus and the specified type of conductor is used.		N/A
	- For apparatus other than those mentioned above, soldering cable lugs or soldered ends of stranded conductors are not acceptable under conditions of heavy vibration. In locations where heavy vibrations exist during normal operation, for example in the case of dredger and crane operation, operation on board ships, lifting equipment and locomotives, attention is given to the support of conductors.		N/A
	– Generally only one conductor is connected to a terminal; the connection of two or more conductors to one terminal is permissible only in those cases where the terminals are designed for this purpose.		N/A
	The dimensioning of solid insulation between separate circuits are based on the circuit of highest rated insulation voltage.		N/A
8.6.4	**Selection and installation of non-protected live conductors to reduce the possibility of short-circuits**		N/A
	Live conductors in an ASSEMBLY that are not protected by short-circuit protective devices (see 8.6.1 and 8.6.2) are selected and installed throughout the entire ASSEMBLY in such a manner that an internal short-circuit between phases or between phase and earth is a remote possibility. See Table 4.		N/A
	Non-protected live conductors selected and installed as in Table 4 and having a SCPD on the load side do not exceed 3 m in length.		N/A
8.6.5	**Identification of the conductors of main and auxiliary circuits**		N/A
	With the exception of the cases mentioned in 8.6.6, the method and the extent of identification of conductors, for example by arrangement, colours or symbols, on the terminals to which they are connected or on the end(s) of the conductors themselves, is the responsibility of the ASSEMBLY manufacturer and is in agreement with the indications on the wiring diagrams and drawings.		N/A
	Where appropriate, identification according to IEC 60445 and IEC 60446 are applied		N/A
8.6.6	**Identification of the protective conductor (PE, PEN) and of the neutral conductor (N) of the main circuits**		N/A
	The protective conductor is readily distinguishable by location and/or marking or colour.		N/A
	If identification by colour is used, it is only green and yellow (twin-coloured), which is strictly reserved for the protective conductor.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	When the protective conductor is an insulated single-core cable, this colour identification is used, preferably throughout the whole length.		N/A
	Any neutral conductor of the main circuit is readily distinguishable by location and/or marking or colour. If identification by colour only is used, it is blue (see IEC 60445).		N/A
8.7	**Cooling**		P
	ASSEMBLIES can be provided with both natural and forced cooling. If special precautions are required at the place of installation to ensure proper cooling, the ASSEMBLY manufacturer furnishes the necessary information (for instance indication of the need for spacing with respect to parts that are liable to impede the dissipation of heat or produce heat themselves).	natural cooling	P
8.8	**Terminals for external conductors**		N/A
	The ASSEMBLY manufacturer indicates whether the terminals are suitable for connection of copper or aluminium conductors, or both.		N/A
	The terminals are such that the external conductors may be connected by a means (screws, connectors, etc.) which ensures that the necessary contact pressure corresponding to the current rating and the short-circuit strength of the apparatus and the circuit is maintained.		N/A
	In the absence of a special agreement between the ASSEMBLY manufacturer and the user, terminals are capable of accommodating copper conductors from the smallest to the largest cross-sectional areas corresponding to the appropriate rated current (see Annex A).		N/A
	Where aluminium conductors are to be terminated, the type, size and termination method of the conductors are as agreed between the ASSEMBLY manufacturer and the user.		N/A
	In the case where external conductors for electronic circuits with low level currents and voltages (less than 1 A and less than 50 V a.c. or 120 V d.c.) have to be connected to an ASSEMBLY, Table A.1 does not apply.		N/A
	The available wiring space permits proper connection of the external conductors of the indicated material and, in the case of multicore cables, spreading of the cores		N/A
	The conductors are not subjected to stresses		N/A
	Unless otherwise agreed between the ASSEMBLY manufacturer and the user, on three-phase and neutral circuits, terminals for the neutral conductor allow the connection of copper conductors having a current-carrying capacity:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– equal to half the current-carrying capacity of the phase conductor, with a minimum of 16 mm^2, if the size of the phase conductor exceeds 16 mm^2;		N/A
	– equal to the full current-carrying capacity of the phase conductor, if the size of the latter is less than or equal to 16 mm^2.		N/A
	If connecting facilities for incoming and outgoing neutral, protective and PEN conductors are provided; they are arranged in the vicinity of the associated phase conductor terminals.		N/A
	Openings in cable entries, cover plates, etc., are so designed that, when the cables are properly installed, the stated protective measures against contact and degree of protection are obtained.		N/A
	The terminals for external protective conductors are marked according to IEC 60445.		N/A
	This symbol No. 5019 of IEC 60417 is not required where the external protective conductor is intended to be connected to an internal protective conductor, which is clearly identified with the colours green and yellow.		N/A
	The terminals for external protective conductors (PE, PEN) and metal sheathing of connecting cables (steel conduit, lead sheath, etc.) are, where required, bare and, unless otherwise specified, suitable for the connection of copper conductors.		N/A
	A separate terminal of adequate size is provided for the outgoing protective conductor(s) of each circuit.		N/A
	Unless otherwise agreed between the ASSEMBLY manufacturer and the user, terminals for protective conductors allow the connection of copper conductors having a cross-section depending on the cross-section of the corresponding phase conductors according to Table 5.		N/A
	In the case of enclosures and conductors of aluminium or aluminium alloys, particular consideration are given to the danger of electrolytic corrosion.		N/A
8.101	**Marking as an obstacle to snow clearance**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Where a PENDA-O is intended for use in regions where heavy snowfalls occur in accordance with 7.2, or alternatively, if required by the user: - it is possible to mark it as an obstacle to snow clearance - holders provided, attached to the PENDA-O, to accommodate marking rods - it is possible to install and make adjustments to the position of the marking rod from outside the PENDA - holders are constructed in a manner which ensures that the holder or marking rod will give way to a mechanical force before the transmitted force to the PENDA-O's enclosure reaches the value which would adversely affect the degree of protection		N/A
8.102	**Ease of operation and maintenance**		N/A
	All parts of the ASSEMBLY are readily accessible and replaceable without excessive dismantling		N/A
	The design is such that the cables can be readily connected from the front		N/A
	When an PENDA does not have a means of measurement incorporated, it is possible, by the use of a portable instrument, to readily and safely measure voltages in all phases of incoming units and on both sides of all current breaking and/or switch devices of outgoing units, also the current in one phase of all outgoing units. During this operation all live parts of the PENDA is protected sufficiently to retain the required degree of protection in accordance with 8.2. Instructions concerning the procedure to be adopted are provided by the manufacturer		N/A
	If the ASSEMBLY is intended to be connected to a live reserve power, the switchgear connecting device is designed so that connection can be made with the live parts having a protection of IP 10		N/A
	Locking arrangements are provided to secure the door(s) and prevent unauthorised access. The fixings of any covers etc. which are removable for installation or maintenance operations are only accessible while the door(s) are open		N/A
9	**PERFORMANCE REQUIREMENTS**		P
9.1	**Dielectric properties**		P
9.1.1	**General**		N/A
	Each circuit of the ASSEMBLY shall be capable of withstanding:		N/A
	-temporary overvoltages;		N/A
	-transient overvoltages,		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The ability to withstand temporary overvoltages, and the integrity of solid insulation, is verified by the power-frequency withstand voltage and the ability to withstand transient overvoltages is verified by the impulse withstand voltage		N/A
9.1.2	**Power-frequency withstand voltage**		P
	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.	1890 V, 50 Hz	P
9.1.3	**Impulse withstand voltage**		N/A
9.1.3.1	**Impulse withstand voltages of main circuits**		N/A
	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.		N/A
	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.		N/A
9.1.3.2	**Impulse withstand voltages of auxiliary circuits**		N/A
	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
	When overvoltage conditions require surge protective devices (SPD's) to be connected to the main busbars, such SPD's are protected to prevent uncontrolled short-circuit conditions as specified by the SPD manufacturer.		N/A
9.2	**Temperature rise limits**		N/A
	The ASSEMBLY and its circuits can carry their rated currents under specified conditions (see 5.3.1, 5.3.2 and 5.3.3 without exceeding the limits given in Table 6 when verified in accordance with 10.10.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The temperature rise of an element or part is the difference between the temperature of this element or part measured in accordance with 10.10.2.3.3 and the ambient air temperature outside the ASSEMBLY.		N/A
	The temperature rises obtained during the test do not cause damage to current-carrying parts or adjacent parts of the ASSEMBLY. In particular, for insulating materials, the ASSEMBLY Manufacturer demonstrates compliance either by reference to the insulation temperature index (determined for example by the methods of IEC 60216) or by compliance with IEC 60085.		N/A
9.3	**Short-circuit protection and short-circuit withstand strength**		N/A
9.3.1	**General**		N/A
	ASSEMBLIES are capable of withstanding the thermal and dynamic stresses resulting from short-circuit currents not exceeding the rated values.		N/A
	ASSEMBLIES are protected against short-circuit currents by means of, for example, circuit breakers, fuses or combinations of both, which may either be incorporated in the ASSEMBLY or arranged outside it.		N/A
9.3.2	**Information concerning short-circuit withstand strength**		N/A
	For ASSEMBLIES with a short-circuit protective device (SCPD) incorporated in the incoming unit, the ASSEMBLY manufacturer indicates the maximum allowable value of prospective short-circuit current at the input terminals of the ASSEMBLY.		N/A
	This value does not exceed the appropriate rating(s) (see 5.3.3, 5.3.4 and 5.3.5). The corresponding power factor and peak values are those shown in 9.3.3.		N/A
	If a circuit breaker with time-delay release is used as the short-circuit protective device, the ASSEMBLY manufacturer states the maximum time-delay and the current setting corresponding to the indicated prospective short-circuit current.		N/A
	For ASSEMBLIES where the short-circuit protective device is not incorporated in the incoming unit, the ASSEMBLY manufacturer indicates the short-circuit withstand strength in one or more of the following ways:		N/A
	a) rated short-time withstand current (I_{cw}) together with the associated duration (see 5.3.4) and rated peak withstand current (I_{pk}) ((see 5.3.3);		N/A
	b) rated conditional short-circuit current (I_{cc}) (see 5.3.5).		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For times up to a maximum of 3 s, the relationship between the rated short-timer current and the associated duration is given by the formula I^2t = constant , provided that the peak value does not exceed the rated peak withstand current.		N/A
	The ASSEMBLY manufacturer indicates the characteristics of the short-circuit protective devices necessary for the protection of the ASSEMBLY.		N/A
	For an ASSEMBLY having several incoming units which are unlikely to be in operation simultaneously, the short-circuit withstand strength can be indicated for each of the incoming units in accordance with the above.		N/A
	For an ASSEMBLY having several incoming units which are likely to be in operation simultaneously, and for an ASSEMBLY having one incoming unit and one or more outgoing high-power units likely to contribute to the short-circuit current, it is necessary to determine the values of the prospective short-circuit current in each incoming unit, in each outgoing unit and in the busbars based on data provided by the user.		N/A
9.3.3	**Relationship between peak current and short-time current**		N/A
	For determining the electrodynamic stresses, the value of peak current is obtained by multiplying the r.m.s.value of the short-circuit current by the factor n. The values for the factor n and the corresponding power factor are given in Table 7.		N/A
9.3.4	**Co-ordination of protective devices**		N/A
	The co-ordination of protective devices within the ASSEMBLY with those to be used external to the ASSEMBLY are the subject of an agreement between the ASSEMBLY manufacturer and the user. Information given in the ASSEMBLY manufacturer's catalogue may take the place of such an agreement.		N/A
	If the operating conditions require maximum continuity of supply, the settings or selection of the short-circuit protective devices within the ASSEMBLY are, where possible, so coordinated that a short circuit occurring in any outgoing circuit is cleared by the switching device installed in the circuit without affecting the other outgoing circuits, thus ensuring selectivity of the protective system.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Where short-circuit protective devices are connected in series and are intended to operate simultaneously to reach the required short-circuit switching capability (i.e. back-up protection), the ASSEMBLY Manufacturer informs the User (e.g. by a warning label in the ASSEMBLY or in the operating instructions, see 6.2) that none of the protective devices are allowed to be replaced by another device which is not of identical type and rating, since the switching capability of the whole combination may otherwise be compromised.		N/A
9.4	**Electromagnetic compatibility (EMC)**		N/A
	For EMC related performance requirements, see J.9.4 of Annex J.		N/A
10	**DESIGN VERIFICATION**		P
	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.	see Attachment No. 5	P
	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		N/A
	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.		—

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Clause	Requirement + Test	Result - Remark	Verdict
	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**		P
10.2.1	**General**		P
	The mechanical, electrical and thermal capability of constructional materials and parts of the ASSEMBLY are deemed to be proven by verification of construction and performance characteristics.	see Attachment No. 5	P
	Where an empty enclosure in accordance with IEC 62208 is used, and it has not been modified so as to degrade the performance of the enclosure, no repetition of the enclosure testing to 10.2 is required.		N/A
10.2.2	**Resistance to corrosion**		P
10.2.2.1	**Test procedure**		P
	The resistance to corrosion of representative samples of ferrous metallic enclosures and internal and external ferrous metallic parts of the ASSEMBLY are verified.		—
	The test are carried out on an enclosure or representative sample showing the same constructional detail as the enclosure itself.	see Attachment No. 5	P
	In all cases hinges, locks and fastenings are also tested unless they have previously been subjected to an equivalent test and their resistance to corrosion has not been compromised by their application.		N/A
	Where the enclosure is subjected to the test it is mounted as for normal use according to the original manufacturer's instructions.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The test specimens is new and in a clean condition and is subjected to severity test A or B, as detailed in 10.2.2.2 and 10.2.2.3.		N/A
10.2.2.2	**Severity test A**		N/A
	This test is applicable to:		N/A
	- metallic indoor enclosures;		N/A
	- external metallic parts of indoor ASSEMBLIES;		N/A
	- internal metallic parts of indoor and outdoor ASSEMBLIES upon which intended mechanical operation may depend.		N/A
	The test consists of:		—
	6 cycles of 24 h each damp heat cycling test according to IEC 60068-2-30 (Test Db) at (55 ±3) ºC and relative humidity of 95 %, and:		N/A
	2 cycles of 24 h each to salt mist test according to IEC 60068-2-11; (Test Ka: Salt mist), at a temperature of (35 ±2) ºC;		N/A
10.2.2.3	**Severity test B**		N/A
	This test is is applicable to:		—
	- metallic outdoor enclosures;		N/A
	- external metallic parts of outdoor ASSEMBLIES;		N/A
	The test comprises two identical 12 day periods;		N/A
	Each 12 day period comprises:		—
	5 cycles of 24 h each damp heat cycling test according to IEC 60068-2-30 (Test Db) at (40 ±3) ºC and relative humidity of 95 %, and:		N/A
	6 cycles of 24 h each to salt mist test according to IEC 60068-2-11; (Test Ka: Salt mist), at a temperature of (35 ±2) ºC;		N/A
10.2.2.4	**Results to be obtained**		N/A
	After the test, the enclosure or samples are washed in running tap water for 5 min, rinsed in distilled or demineralized water then shaken or subjected to air blast to remove water droplets. The specimen under test is then stored under normal service conditions for 2 h.		N/A
	Compliance is checked by visual inspection to determine that:		—

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Clause	Requirement + Test	Result - Remark	Verdict
	– there is no evidence of iron oxide, cracking or other deterioration more than that allowed by ISO 4628-3 for a degree of rusting Ri1. However surface deterioration of the protective coating is allowed. In case of doubt associated with paints and varnishes, reference is made to ISO 4628-3 to verify that the samples conform to the specimen Ri1;		N/A
	– the mechanical integrity is not impaired;		N/A
	– seals are not damaged,		N/A
	– doors, hinges, locks, and fastenings work without abnormal effort.		N/A
10.2.3	**Properties of insulating materials**		N/A
10.2.3.1	**Verification of thermal stability of enclosures**		N/A
	The thermal stability of enclosures manufactured from insulated material is verified by the dry heat test. The test is carried out according to IEC 60068-2-2 Test Bb, at a temperature of 70 °C, with natural air circulation, for a duration of 168 h and with a recovery of 96 h.		N/A
	Parts, intended for decorative purposes that have no technical significance are not considered for the purpose of this test.		N/A
	The enclosure, mounted as for normal use, is subjected to a test in a heating cabinet with an atmosphere having the composition and pressure of the ambient air and ventilated by natural circulation. If the dimensions of the enclosure are inconsistent with those of the heating cabinet, the test may be carried out on a representative sample of the enclosure.		N/A
	The use of an electrically heated cabinet is recommended.		N/A
	The enclosure or sample shows no crack visible to normal or corrected vision without additional magnification nor does the material have become sticky or greasy, this being judged as follows:		N/A
	With the forefinger wrapped in a dry piece of rough cloth, the sample is pressed with a force of 5 N.		N/A
	No traces of the cloth remains on the sample and the material of the enclosure or sample does not stick to the cloth.		N/A
10.2.3.2	**Verification of resistance of insulating materials to abnormal heat and fire due to internal electric effects**		P
	The glow-wire test principles of IEC 60695-2-10 and the details given in IEC 60695-2-11 are used to verify the suitability of materials used:	IEC 60695-2-10 and IEC 60695-2-11	—

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Clause	Requirement + Test	Result - Remark	Verdict
	a) on parts of ASSEMBLIES, or	see Attachment No. 5	P
	b) on parts taken from these parts.		N/A
	The test is carried out on material with the minimum thickness used for the parts in a) or b).		N/A
	The temperature of the tip of the glow-wire is as follows:		—
	– 960 °C for parts necessary to retain current-carrying parts in position;		N/A
	- 850 °C for enclosures intended for mounting in hollow walls;		N/A
	– 650 °C for all other parts, including parts necessary to retain the protective conductor.		N/A
	The specimen is considered to have withstood the glow-wire test if		—
	– there is no visible flame and no sustained glowing, or if		N/A
	– flames and glowing of the specimen extinguish within 30 s after removal of the glow-wire.		N/A
	There is no burning of the tissue paper or scorching of the pinewood board.		N/A
	As an alternative the original manufacturer may provide data on the suitability of materials from the insulating material supplier to demonstrate compliance with the requirements of 8.1.3.2.3		N/A
10.2.3.101	**Dry heat test**		P
	The complete ASSEMBLY placed in an oven, the internal temperature of which is raised to (100±2) °C over a period of 2 h to 3 h and maintained at this temperature for 5 h	100 °C. See Attachment No. 4	P
	No visible signs of deterioration. Deformation of protective covers manufactured from insulating materials is acceptable if they are more than 6 mm distant from parts which may have a temperature rise in excess of 40 K and do not support live components		N/A
10.2.3.102	**Verification of category of flammability**		P
	Representative specimens of each of the materials of enclosures, barriers and other insulating parts subjected to a flammability test in accordance with test method A – horizontal burning test of IEC 60695-11-10	see Attachment No. 5	P
	Compliance is checked by inspection that each set of specimens can be classified to category HB40 criteria a) or b) in accordance with 8.4.1 of IEC 60695-11-10		N/A
10.2.4	**Resistance to ultra-violet (UV) radiation**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	This test applies only to enclosures and external parts of ASSEMBLIES intended to be installed outdoors and which are constructed of insulating materials or metals that are entirely coated by synthetic material. Representative samples of such parts are subjected to the test		N/A
	UV test according to ISO 4892-2 method A; 1 000 cycles of 5 min of watering and 25 min of dry period with xenon lamp providing a total test period of 500 h.		N/A
	The values of temperature and humidity used for the test are (65 ±3) °C and (65 ±5) % respectively, unless declared otherwise by the original manufacturer.		N/A
	For enclosures constructed of insulating materials compliance is checked by verification that the flexural strength (according to ISO 178) and Charpy impact (according to ISO 179) of insulating materials have 70 % minimum retention.		N/A
	For the test carried out in accordance with ISO 178, the surface of the sample exposed to UV is turned face down and the pressure applied to the non exposed surface.		N/A
	For the test carried out in accordance with ISO 179 no grooves are cut into the sample and the impact is applied to the exposed surface.		N/A
	After the test, samples are subjected to the glow-wire test of 10.2.3.3.		N/A
	For compliance, enclosures constructed of metals entirely coated by synthetic material, the adherence of the synthetic material (according to ISO 2409) have 50 % minimum retention.		N/A
	Samples show no cracks or deterioration visible to normal or corrected vision without additional magnification.		N/A
	This test need not be carried out if the original manufacturer can provide data from the material supplier to demonstrate that materials of the same thickness or thinner comply with this requirement.	see Attachment No. 5	P
10.2.5	**Lifting**		N/A
	The maximum number of sections allowed by the original manufacturer to be lifted together are equipped with components and/or weights to achieve a weight of 1,25 times its maximum shipping weight. ..... :		N/A
	With doors closed it is lifted with the specified lifting means and in the manner defined by the original manufacturer.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	From a standstill position, the ASSEMBLY is raised smoothly without jerking in a vertical plane to a height of ≥1 m and lowered in the same manner to a standstill position. This test is repeated a further two times after which the ASSEMBLY is raised up and suspended clear of the floor for 30 min without any movement.		N/A
	Following this test the ASSEMBLY is raised smoothly without jerking from a standstill position to a height of (≥1 m and moved (10 ± 0,5) m horizontally, then lowered to a standstill position. This sequence, is carried out three times at uniform speed, each sequence being carried out within 1 min.		N/A
	During the test, with the test weights in place, the ASSEMBLY shows no deflections and after the test show no cracks or permanent distortions visible to normal or corrected vision without additional magnification, which could impair any of its characteristics.		N/A
10.2.6	**Mechanical impact**		P
	Mechanical impact tests where required by the specific ASSEMBLY standard are to be carried out in accordance with IEC 62262.	mechanical impact – see Attachment No. 4	P
10.2.7	**Marking**		P
	Marking made by moulding, pressing, engraving or similar, including labels with a laminated plastic covering, is not submitted to the following test.	see Attachment No. 4	P
	The test is made by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and then for 15 s with a piece of cloth soaked with petroleum spirit.		N/A
	After the test the marking is legible to normal or corrected vision without additional magnification.		N/A
10.2.101	**Verification of mechanical strength**		P
10.2.101.1	**General**		P
	The tests carried out at an ambient temperature of between 10 °C and 40 °C		P
	All tests carried out with the ASSEMBLY fixed at its normal service mounting and where appropriate, added support at normal ground level as indicated in Figures 102a, 102b, 103a, and 103b	according to the Figures 103a, and 103b	P
10.2.101.2	**Verification of resistance to static load**	product object No. 1	P
	Test 1 - load of 8500 N/m²; for 5 min to the roof of the enclosure	No. 1: 0,098 m²; load: 837,0 N.	P
	Test 2 - force 1200 N; for 5 min in turn to the front and back upper edges of the roof of the enclosure	force 1200 N; for 5 min	P

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Clause	Requirement + Test	Result - Remark	Verdict
	After the tests: - degree of protection is in accordance with 8.2.2		P
	- operation of door(s) and locking points not impaired		P
	- electrical clearances remained satisfactory		N/A
	- in case of metallic enclosure, no contact between live parts and the enclosure		N/A
10.2.101.3	**Verification of resistance to shock load**	product object No. 1	P
	A bag with dry sand, mass 15 kg, at least 1 m above the highest point of the CDC	mass 15 kg	P
	one blow to upper parts of each of the vertical surfaces (If enclosure cylindrical, three blows)	4 x 1 blow	P
	After the tests: - degree of protection is in accordance with 8.2.2	IP44	P
	- operation of door(s) and locking points not impaired		P
	- electrical clearances remained satisfactory		N/A
	- in case of metallic enclosure, no contact between live parts and the enclosure		N/A
	- in case of insulating enclosure, no associated cracks	no associated cracks	P
10.2.101.4	**Verification of resistance to torsional stress**	product object No. 1	P
	horizontally rotatable frame used, 60x60x5 mm		P
	torsional force 2x1000 N applied for 30 s as shown in Figures 106a and 106b	torsional force 2x1000 N applied for 30 s	P
	After the tests: - the door(s) remain closed		P
	- degree of protection is in accordance with 8.2.2.	IP44	P
10.2.101.5	**Verification of impact force withstand**		P
10.2.101.5.1	**Test applicable to PENDAs designed for ambient temperatures of between 40ºC and -25ºC**	product object No. 1	P
	solid steel ball of 2 kg mass, raised 1 m providing an impact energy of 20 J (see Figures 103a, 103b)	solid steel ball of 2 kg mass (see Figure 103a)	P
	one blow aimed at the centre of each of the vertical surfaces (If enclosure cylindrical, three blows)	11 x 1 blow	P
	Test 1: ambient air temperature between 10ºC and 40ºC, PENDA not less than 12 h	23 ºC	P
	Test 2: ambient air temperature between 10ºC and 40ºC, after PENDA at –25ºC not less than 12 h	–25ºC, 12h	P
	After the tests: - degree of protection is in accordance with 8.2.2	IP44	P

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Clause	Requirement + Test	Result - Remark	Verdict
	- operation of door(s) and locking points not impaired		P
	- electrical clearances remained satisfactory		P
	- in case of metallic enclosure, no contact between live parts and the enclosure		N/A
	- in case of insulating enclosure, no associated cracks	no associated cracks	P
10.2.101.5.2	**PENDAs designed for operation in an arctic climate (see 7.1.1.2)**	product object No. 2	P
	test ambient air temperature between 10 ºC and 40 ºC, after PENDA has been kept at -50 ºC not less than 12 h and at a time when the external temperature of the enclosure has recovered to a temperature not higher than –40 °C	-50 ºC, 12 h	P
	Test 1 and 2: force of 1500 N for 30 s at 10 weakest points.	Test 1: force of 1500 N for 30 s at 10 weakest points.	P
	Test 1 carried out on an empty PENDA		P
	Test 2 carried out on a PENDA containing equipment which provides the minimum clearances inside the enclosure.		N/A
	Test 3 carried out on an empty PENDA using an impact apparatus as described in 10.2.101.2.1 with a solid steel ball, mass 15 kg, 150 J		P
	one blow at the centre (If enclosure is cylindrical, three blows)	one blow at the centre	P
	test 1: degree of protection remains in accordance with 8.2.2, operation of door(s) and locking points not impaired		P
	test 2: no puncture or flashover occurs		N/A
	test 3: degree of protection at least IP3X	IP44	P
10.2.101.6	**Verification of mechanical strength of doors**		P
	The test applies to PENDA-O having a door(s) hinged on a vertical edge of the enclosure	see Attachment No. 5	P
	door(s) open, load 50 N maintained for 3 s.		N/A
	test repeated with load increased to 450 N		N/A
	door(s) not become unhinged, not impaired by a load of 50 N. In addition, by verification that the degree of protection remains in accordance with 8.2.2		N/A
	degree of protection remains in accordance with 8.2.2 after door(s) closed following load of 450 N		N/A
10.2.101.7	**Verification of resistance to axial load of metal inserts in synthetic material**		N/A
	test carried out on representative specimen		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	PENDA is fully supported on a platform		N/A
	A screw-eye fitted, axial force; applied for 10 s		N/A
	inserts remain undamaged		N/A
	no cracking of the surrounding material		N/A
10.2.101.8	**Verification of resistance to mechanical shock impacts induced by sharp-edged objects**	product object No. 1	P
	Test carried out using an impact apparatus, mass 5 kg, 20 J	impact apparatus, mass 5 kg, 20 J	P
	one blow at weakest point (If enclosure is cylindrical, three blows)		P
	Test 1: ambient air temperature between 10ºC and 40ºC, PENDA not less than 12 h	23 ºC,12 h; 11 blow	P
	Test 2: ambient air temperature between 10ºC and 40ºC, after PENDA at –25ºC not less than 12 h	23 ºC ;–25ºC, 12 h, 11 blow	P
	no cracks within a circle of diameter not exceeding 15 mm.		P
10.2.101.9	**Test of mechanical strength of the base**	product object No. 1	P
	PENDA is fixed to the base	PENDA	P
	force applied by means of steel tubes. F = 3,5 N/mm x L, for 1 min.	L= 397 mm; F = 3,5 N/mm x 397 mm = 1386 N for 1 min.	P
	Repeated on base of similar length but different profile		N/A
	base has not broken		P
	degree of protection of CDC part normally above ground remains in accordance with 8.2.2	IP44	P
10.3	**DEGREE OF PROTECTION OF PCS-ASSEMBLIES**		P
	The degree of protection provided is verified in accordance with IEC 60529; the test may be carried out on a representative equipped ASSEMBLY.	IP44 in accordance with IEC 60529. See Attachment No. 4	P
	Where an empty enclosure in accordance with IEC 62208 is used, a verification assessment shall be performed to ensure that any external modification that has been carried out does not result in a deterioration of the degree of protection. In this case no further testing is required.		N/A
	ASSEMBLIES having a degree of protection of IP 5X are tested according to category 2 in 13.4 of IEC 60529.		N/A
	ASSEMBLIES having a degree of protection of IP 6X are tested according to category 1 in 13.4 of IEC 60529.		N/A
	The test device for IP X3 and IP X4 as well as the type of support for the enclosure during the IP X4 test is stated in the test report.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The IP X1 to IP X6 tests on an ASSEMBLY are deemed to be a failure if any water comes into contact with electrical equipment housed within the enclosure. Ingress of water is permissible only if its route of entry is obvious and the water is only in contact with the enclosure at a location where it will not impair safety.		N/A
10.4	**Clearances and creepage distances**		N/A
	The clearances are sufficient to enable the declared rated impulse withstand voltage (U_{imp}) of a circuit to be achieved. Rated impulse withstands voltage. .....:		N/A
	Required clearances as specified in Table 1. .....:		N/A
	Measured clearances .....:		N/A
	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 .....:		N/A
	Pollution degree. .....:		N/A
	Material group . .....:		N/A
	Minimum creepage distances required.....:		N/A
	The creepage distances measured .....:		N/A
	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
10.5.1	**Effectiveness of the protective circuit**		N/A
	The effectiveness of the protective circuit is verified for the following function:		N/A
	a) protection against the consequences of fault within the ASSEMBLY (internal faults) as outlined in 10.5.2, and		N/A
	b) protection against the consequences of fault in external circuits supplied through the ASSEMBLY (external faults) as outlined in 10.5.3.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10.5.2	**Effective earth continuity between the exposed conductive parts of the ASSEMBLY and the protective circuit**		N/A
	It is verified that the different exposed conductive parts of the ASSEMBLY are effectively connected to the terminal for the incoming external protective conductor and that the resistance of the circuit does not exceed 0,1 Ω		N/A
	Verification is made using a resistance measuring instrument which is capable of driving a current of at least 10 A (a.c. or d.c.).		N/A
	The current is passed between each exposed conductive part and the terminal for the external protective conductor. The resistance does not exceed 0,1 Ω		N/A
10.5.3	**Short-circuit withstand strength of the protective circuit**		N/A
	The short-circuit withstand strength is verified.		N/A
	The original manufacturer determines the reference design(s) that will be used in 10.5.3.3 and 10.5.3.4.		N/A
10.5.3.2	**Protective circuits that are exempted from short-circuit withstand verification**		N/A
	Where a separate protective conductor is provided in accordance with 8.4.3.2.3, short-circuit testing is not required if one of the conditions of 10.11.2. is fulfilled.		N/A
10.5.3.3	**Verification by comparison with a reference design – Utilising a check list**		N/A
	Verification by design rules is achieved when comparison of the ASSEMBLY to be verified with an already tested design utilising items 1 to 6 and 8 to 10 of the check list in Table 13 shows no deviations.		N/A
10.5.3.4	**Verification by comparison with a reference design – Utilising calculation**		N/A
	Verification by comparison with a reference design based on calculation is to be in accordance with 10.11.4		N/A
10.5.3.5	**Verification by test**		N/A
	Subclause 10.11.5.6 applies.		N/A
10.6	**Incorporation of switching devices and components**		N/A
10.6.1	**General**		N/A
	Compliance with the design requirements of 8.5 for the incorporation of switching devices and components is confirmed by inspection and verified to the requirements of this standard.		N/A
10.6.2	**Electromagnetic compatibility**		N/A
	The performance requirements of J.9.4 for electromagnetic compatibility is confirmed by inspection or where necessary by test (see J.10.12).		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10.7	**Internal electrical circuits and connections**		N/A
	Compliance with the design requirements of 8.6 for internal electrical circuits and connections is confirmed by inspection and verified to this standard.		N/A
10.8	**Terminals for external conductors**		N/A
	Compliance with the design requirements of 8.8 for terminals for external conductors is confirmed by inspection.		N/A
10.9	**Dielectric properties**		P
10.9.1	**General**		N/A
	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.		N/A
	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**		N/A
10.9.2.1	**Main, auxiliary and control circuits**		N/A
	Main, auxiliary and control circuits that are connected to the main circuit are subjected to the test voltage according to Table 8.		N/A
	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**		N/A
	The test voltage has a practically sinusoidal waveform and a frequency between 45 Hz and 65 Hz.		N/A
	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.		N/A
	The overcurrent relay does not trip when the output current is less than 100 mA.		N/A
	The value of the test voltage is that specified in Table 8 or 9 as appropriate with a permitted tolerance of ± 3 %.		N/A
10.9.2.3	**Application of the test voltage**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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:		N/A
	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		N/A
	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
	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.		N/A
10.9.3	**Impulse withstand voltage**		N/A
10.9.3.1	**General**		—
	Verification shall be made by test or by assessment		N/A
	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.		N/A
10.9.3.2	**Impulse withstand voltage test**		N/A
	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 ±3 %.		N/A
	Impulse withstand voltage (U_{imp}) ..... :		N/A
	Auxiliary circuits not connected to main circuits are connected to earth.		N/A
	The 1,2/50 µs impulse voltage is applied to the ASSEMBLY five times for each polarity at intervals of 1 s minimum as follows:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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		N/A
	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.		N/A
	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
	The test voltage has a practically sinusoidal waveform and a frequency between 45 Hz and 65 Hz.		N/A
	The overcurrent relay does not trip when the output current is less than 100 mA.		N/A
	The value of the test voltage is that specified in 9.1.3 and Table 10 as appropriate with a permitted tolerance of ±3 %.		N/A
	Power-frequency ..... :		N/A
	The power-frequency voltage is applied once, at full value, for a duration sufficient for the magnitude to be ascertained, but it is not less than 15 ms.		N/A
	It is applied:		N/A
	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		N/A
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	For an acceptable result the overcurrent relay does not operate and there is no disruptive discharge during the tests.		N/A
10.9.3.4	**Alternative d.c. voltage test**		N/A
	The test voltage has negligible ripple.		N/A
	The high-voltage source 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.		N/A
	The overcurrent relay does not trip when the output current is less than 100 mA.		N/A
	The value of the test voltage is that specified in 9.1.3 and Table 10 as appropriate with a permitted tolerance of ±3 %.		N/A
	Alternative d.c. voltage ..... :		N/A
	The d.c. voltage is applied once for each polarity for a duration sufficient for the magnitude to be ascertained, but it isl not less than 15 ms or greater than 100 ms.		N/A
	It is applied:		N/A
	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		N/A
	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
	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
	For an acceptable result the overcurrent relay does not operate and there is no disruptive discharge during the tests.		N/A
10.9.3.5	**Verification assessment**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Clearances are verified by measurement, or verification of measurements on design drawings, employing the measurement methods stated in Annex F.		N/A
	The clearances are at least 1,5 times the values specified in Table 1.		N/A
	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}).		N/A
10.9.4	**Testing of enclosures made of insulating material**		P
	For ASSEMBLIES with enclosures made of insulating material, an additional dielectric test is carried out by applying an a.c. test voltage between a metal foil laid on the outside of the enclosure over openings and joints, and the interconnected live and exposed conductive parts within the ASSEMBLY located next to the openings and joints.	1890 V, 50 Hz	P
	For this additional test, the test voltage is equal to 1,5 times the values indicated in Table 8.	1,5 x 1890 V = 2835 V, 50 Hz- see Attachment No. 4	P
10.9.5	**External operating handles of insulating material**		N/A
	A dielectric test is carried out on handles made of or covered by insulating material by applying a test voltage equal to 1,5 times the test voltage indicated in Table 8 between the live parts and a metal foil wrapped round the whole surface of the handle.		N/A
10.10	**VERIFICATION OF TEMPERATURE RISE**		N/A
10.10.1	**General**		N/A
	It is verified that the temperature-rise limits specified in 9.2 for the different parts of the ASSEMBLY or ASSEMBLY system will not be exceeded.		N/A
	Verification is made by one or more of the following methods:		N/A
	a) testing (10.10.2);		N/A
	b) derivation (from a tested design) of ratings for similar variants (10.10.3); or		N/A
	c) calculation (10.10.4).		N/A
	In ASSEMBLIES rated for frequencies above 60 Hz verification of temperature rise by test (10.10.2) or by derivation from a similar design tested at the same intended frequency (10.10.3) is always required.		N/A
10.10.2	**Verification by testing**		N/A
10.10.2.1	**General**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	1) If the ASSEMBLY to be verified comprises a number of variants, the most onerous arrangement(s) of the ASSEMBLY is selected according to 10.10.2.2.		N/A
	2) The ASSEMBLY is verified by one of the following methods:		N/A
	a) considering individual functional units, the main and distribution busbars and the ASSEMBLY collectively according to 10.10.2.3.5;		N/A
	b) considering individual functional units separately and the complete ASSEMBLY including the main and distribution busbars according to 10.10.2.3.6;		N/A
	c) considering individual functional units and the main and distribution busbars separately as well as the complete ASSEMBLY according to 10.10.2.3.7.		N/A
	3) When the ASSEMBLIES tested are the most onerous variants out of a larger product range then the test results can be used to establish the ratings of similar variants without further testing. Rules for such derivations are given in 10.10.3		N/A
10.10.2.2	**Selection of the representative arrangement**		N/A
10.10.2.2.1	**General**		N/A
	The test is made on one or more representative arrangements loaded with one or more representative load combinations chosen to obtain with reasonable accuracy the highest possible temperature rise.		N/A
	The selection of the representative arrangements to be tested is given in 10.10.2.2.2 and 10.10.2.2.3 and is the responsibility of the original manufacturer		N/A
	The original manufacturer takes into consideration in his selection for test, the configurations to be derived from the tested arrangements according to 10.10.3		N/A
10.10.2.2.2	**Busbars**		N/A
	variants of which differ only in the reduction of height, or reduction of thickness or quantity of bars per conductor, but which have the same arrangement of bars, the same conductor spacing, the same enclosure and busbar compartment (if any), as a minimum for the test, the busbars with the greatest cross-sectional area is selected as the representative arrangement.		N/A
	For ratings of smaller busbar size variants or other materials see 10.10.3.3.		N/A
10.10.2.2.3	**Functional units**		N/A
	a) Selection of comparable functional unit groups		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Functional units intended to be used at different rated currents can be considered to have a similar thermal behaviour and form a comparable range of units, if they fulfil the following conditions:		N/A
	1) the function and basic wiring diagram of the main circuit is the same (e.g. incoming unit, reversing starter, cable feeder);		N/A
	2) the devices are of the same frame size and belong to the same series;		N/A
	3) the mounting structure is of the same type;		N/A
	4) the mutual arrangement of the devices is the same;		N/A
	5) the type and arrangement of conductors is the same;		N/A
	6) the cross-section of the main circuit conductors within a functional unit has a rating at least equal to that of the lowest rated device in the circuit. Selection of conductors are as tested or in accordance with IEC 60364-5-52. Examples on how to adapt this standard for conditions inside an ASSEMBLY are given in the tables included in Annex H.		N/A
	b) Selection of a critical variant out of each comparable group as a specimen for test		N/A
	For the critical variant the most onerous compartment (where applicable) and enclosure conditions (with respect to shape, size, design of partitions and enclosure ventilation) is tested.		N/A
	The maximum possible current rating for each variant of functional unit is established.		N/A
	For functional units containing only one device this is the rated current of the device.		N/A
	For functional units with several devices, it is that of the device with the lowest rated current.		N/A
	If a combination of devices connected in series is intended to be used at a lower current (e.g. motor starter combination), this lower current is used.		N/A
	For each functional unit the power loss is calculated at the maximum possible current using the data given by the device manufacturer for each device together with the power losses of the associated conductors.		N/A
	For functional units with currents up to and including 630 A, the critical unit in each range is the functional unit with the highest total power loss.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For functional units with currents above 630 A the critical unit in each range is that which has the highest rated current. This ensures that additional thermal effects relating to eddy currents and current displacement are taken into consideration.		N/A
	The critical functional unit is at least tested inside the smallest compartment (if any) which is intended for this functional unit; and with the worst variant of internal separation (if any) with respect to size of ventilation openings; and the enclosure with the highest installed power loss per volume; and the worst variant of ventilation of the enclosure with respect to kind of ventilation (natural or forced convection) and size of ventilation openings.		N/A
	If the functional unit can be arranged in different orientations (horizontal, vertical), then the most onerous arrangement is tested.		N/A
10.10.2.3	**Methods of test**		N/A
	The temperature-rise test on the individual circuits is made with the type of current for which they are intended, and at the design frequency.		N/A
	Coils of relays, contactors, releases, etc., are supplied with rated operational voltage		N/A
	The ASSEMBLY is mounted as in normal use, with all covers including bottom cover plates, etc., in place.		N/A
	If the ASSEMBLY includes fuses, these are fitted for the test with fuse-links as specified by the manufacturer.		N/A
	The power losses of the fuse-links used for the test are stated		N/A
	The size and the disposition of external conductors used for the test are stated in the test report.		N/A
	The test is made for a time sufficient for the temperature rise to reach a constant value. In practice, this condition is reached when the variation at all measured points (including the ambient air temperature) does not exceed 1 K/h.		N/A
	To shorten the test, if the devices allow it, the current may be increased during the first part of the test, it being reduced to the specified test current afterwards.		N/A
	When a control electro-magnet is energized during the test, the temperature is measured when thermal equilibrium is reached in both the main circuit and the control electro-magnet.		N/A
	Temperature-rise tests on the circuit(s) carried out at 50 Hz are applicable to 60 Hz for rated currents up to and including 800 A.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For currents above 800 A, the rated current at 60 Hz is reduced to 95 % of that at 50 Hz.		N/A
	Alternatively, where the maximum temperature rise at 50 Hz does not exceed 90 % of the permissible value, then de-rating for 60 Hz is not required.		N/A
	Tests on an individual section of the ASSEMBLY are acceptable provided the conditions of 10.10.2.2 are met.		N/A
	To make the test representative the external surfaces at which additional sections may be connected are thermally insulated with a covering to prevent any undue cooling.		N/A
	When testing individual functional units within a section, the adjacent functional units can be replaced by heating resistors if the rating of each does not exceed 630 A and their rating is not to be verified with this test.		N/A
	In ASSEMBLIES where there is a possibility that additional control circuits or devices may be incorporated, heating resistors simulate the power dissipation of these additional items.		N/A
10.10.2.3.2	**Test conductors**		N/A
	In the absence of detailed information concerning the external conductors and the service conditions, the cross-section of the external test conductors are in accordance with the following.		N/A
	1) **For values of rated current up to and including 400 A:**		N/A
	a) the conductors are single-core, copper cables or insulated wires with cross-sectional areas as given in Table 11;		N/A
	b) as far as practicable, the conductors are in free air;		N/A
	c) the minimum length of each temporary connection from terminal to terminal is: – 1 m for cross-sections up to and including 35 mm^2; – 2 m for cross-sections larger than 35 mm^2.		N/A
	2) **For values of rated current higher than 400 A but not exceeding 800 A:**		N/A
	a) The conductors are single-core copper cables with cross-sectional areas as given in Table 12, or the equivalent copper bars given in Table 12 as specified by the original manufacturer.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	b) Cables or copper bars are spaced at approximately the distance between terminals. Multiple parallel cables per terminal are bunched together and arranged with approximately 10 mm air space between each other. Multiple copper bars per terminal are spaced at a distance approximately equal to the bar thickness. If the sizes stated for the bars are not suitable for the terminals or are not available, it is allowed to use other bars having the same cross-sectional dimensions ±□10 % and the same or smaller cooling surfaces. Cables or copper bars are not interleaved.		N/A
	c) For single-phase or multi-phase tests, the minimum length of any temporary connection to the test supply is 2 m. The minimum length to a star point may be reduced to 1,2 m where agreed by the original manufacturer.		N/A
	3) **For values of rated current higher than 800 A but not exceeding 4000 A:**		N/A
	a) The conductors are copper bars of the sizes stated in Table 12 unless the ASSEMBLY is designed only for cable connection. In this case, the size and arrangement of the cables are as specified by the original manufacturer.		N/A
	b) Copper bars are spaced at approximately the distance between terminals. Multiple copper bars per terminal are spaced at a distance approximately equal to the bar thickness. If the sizes stated for the bars are not suitable for the terminals or are not available, it is allowed to use other bars having the same cross-sectional dimensions ±□10 % and the same or smaller cooling surfaces. Copper bars are not interleaved.		N/A
	c) For single-phase or multi-phase tests, the minimum length of any temporary connection to the test supply is 3 m, but this can be reduced to 2 m provided that the temperature rise at the supply end of the connection is not more than 5 K below the temperature rise in the middle of the connection length. The minimum length to a star point is 2 m.		N/A
	4) **For values of rated current higher than 4 000 A:**		N/A
	The original manufacturer determines all relevant items of the test, such as type of supply, number of phases and frequency (where applicable), cross-sections of test conductors, etc. This information is part of the test report.		N/A
10.10.2.3.3	**Measurement of temperatures**		N/A
	Thermocouples or thermometers are used for temperature measurements.		N/A
	For windings, the method of measuring the temperature by resistance variation is used.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The thermometers or thermocouples is protected against air currents and heat radiation.		N/A
	The temperature is measured at all points where a temperature-rise limit (see 9.2) must be observed.		N/A
	Particular attention is given to joints in conductors and terminals within the main circuits.		N/A
	For measurement of the temperature of air inside an ASSEMBLY, several measuring devices are arranged in convenient places.		N/A
10.10.2.3.4	**Ambient air temperature**		N/A
	The ambient air temperature is measured by means of at least two thermometers or thermocouples equally distributed around the ASSEMBLY at approximately half its height and at a distance of approximately 1 m from the ASSEMBLY.		N/A
	The thermometers or thermocouples are protected against air currents and heat radiation.		N/A
	The ambient temperature during the test is between +10 °C and +40 °C.		N/A
10.10.2.3.5	**Verification of the complete ASSEMBLY**		N/A
	Incoming and outgoing circuits of the ASSEMBLY are loaded with their rated currents that result in the rated diversity factor being equal to 1.		N/A
	If the rated current of the incoming circuit or distribution busbar system is less than the sum of the rated currents of all outgoing circuits, then the outgoing circuits shall be split into groups corresponding to the rated current of the incoming circuit or distribution busbar system.		N/A
	The groups are formed in a manner so that the highest possible temperature rise is obtained.		N/A
	Sufficient groups are formed and tests undertaken so as to include all different variants of functional units in at least one group.		N/A
	Where the fully loaded circuits do not distribute exactly the total incoming current, the remaining current is distributed via any other appropriate circuit.		N/A
	This test is repeated until all types of outgoing circuit have been verified at their rated current.		N/A
	Change in the arrangement of functional units within a verified ASSEMBLY, or section of an ASSEMBLY may necessitate additional tests as the thermal influence of the adjacent units may differ significantly.		N/A
10.10.2.3.6	**Verification considering individual functional units separately and the complete ASSEMBLY**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The rated currents of the circuits according to 5.3.2 and the rated diversity factor according to 5.3.3 are verified in two stages.		N/A
	Individual functional units are verified separately in accordance with 10.10.2.3.7 c).		N/A
	The ASSEMBLY is verified by loading the incoming circuit to its rated current and all outgoing functional units collectively to their rated current multiplied by the diversity factor.		N/A
	If the rated current of the incoming circuit or distribution busbar system is less than the sum of the test currents of all outgoing circuits (i.e. the rated currents multiplied by the diversity factor), then the outgoing circuits shall be split into groups corresponding to the rated current of the incoming circuit or distribution busbar system.		N/A
	The groups as defined by the original manufacturer are formed in a manner so that the highest possible temperature rise is obtained.		N/A
	Sufficient groups are formed and tests undertaken so as to include all different variants of functional units in at least one group.		N/A
	Where the fully loaded circuits do not distribute exactly the total incoming current, the remaining current is distributed via any other appropriate circuit.		N/A
	This test is repeated until all types of outgoing circuit have been verified at their rated current.		N/A
	Change in the arrangement of functional units within a verified ASSEMBLY, or section of an ASSEMBLY may necessitate additional tests as the thermal influence of the adjacent units may differ significantly.		N/A
10.10.2.3.7	**Verification considering individual functional units and the main and distribution busbars separately as well as the complete ASSEMBLY**		N/A
	ASSEMBLIES are verified by separate verification of standard elements (a) to c)) as selected in accordance with 10.10.2.2.2 and 10.10.2.2.3, and verification of a complete ASSEMBLY (d)) under worst case conditions as detailed below:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	a) Main busbars are tested separately. They are mounted in the ASSEMBLY enclosure as in normal use with all covers and all partitions that separate the main busbars from other compartments, in place. If the main busbar has joints, then they are included in the test. The test is carried out at rated current. The test current passes through the full length of the busbars. Where the design of the ASSEMBLY permits, and, to minimise the influence of the external test conductors on the temperature rise, the length of the main busbar within the enclosure for the test has a minimum of 2 m and include a minimum of one joint when the busbars are extendable.		N/A
	b) Distribution busbars are tested separately from the outgoing units. They are mounted in the enclosure as in normal use with all covers and all partitions that separate the busbar from other compartments, in place. Distribution busbars are connected to the main busbar. No other conductors, e.g. connections to functional units, are connected to the distribution busbar. In order to consider the most onerous condition, the test is carried out at rated current and the test current passes through the full length of the distribution busbar. If the main busbar is rated for a higher current, it is fed with additional current so that it carries its rated current to its junction with the distribution busbar.		N/A
	c) Functional units are tested individually. The functional unit is mounted in the enclosure as in normal use with all covers and all internal partitions in place. If it can be mounted at different places the most unfavourable place is used. It is connected to the main or the distribution busbar as in normal use. If the main busbar and/or the distribution busbar (if any) are rated for a higher current, they are fed with additional currents so that they carry their individual rated currents to the respective junction points. The test is carried out at rated current for the functional unit.		N/A
	d) The complete ASSEMBLY shall be verified by temperature rise testing of the most onerous arrangement(s) possible in service and as defined by the original manufacturer. For this test the incoming circuit is loaded to its rated current and each outgoing functional unit to its rated current multiplied by the rated diversity factor. The groups shall be formed in a manner so that the highest possible temperature rise is obtained. Sufficient groups shall be formed and tests undertaken so as to include all different variants of functional units in at least one group.		N/A
10.10.2.3.8	**Results to be obtained**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	At the end of the test, the temperature rise does not exceed the values specified in Table 6.		N/A
	The apparatus operates satisfactorily within the voltage limits specified for them at the temperature inside the ASSEMBLY.		N/A
10.10.3	**Derivation of ratings for similar variants**		N/A
10.10.3.1	**General**		N/A
10.10.3.2	**ASSEMBLIES**		N/A
	The ASSEMBLY that incorporates non-tested variants are verified by derivation from similar tested arrangements.		N/A
	ASSEMBLIES verified in this manner comply with the following:		N/A
	a) the functional units belong to the same group as the functional unit selected for test (see 10.10.2.2.3);		N/A
	b) the same type of construction as used for the test;		N/A
	c) the same or increased overall dimensions as used for the test;		N/A
	d) the same or increased cooling conditions as used for the test (forced or natural convection, same or larger ventilation openings);		N/A
	e) the same or reduced internal separation as used for the test (if any);		N/A
	f) the same or reduced power losses in the same section as used for the test;		N/A
	g) the same or reduced number of outgoing circuits for every section		N/A
	The ASSEMBLY being verified may comprise all or only part of the electrical circuits of the ASSEMBLY previously verified.		N/A
	Alternative arrangement(s) of functional units within the ASSEMBLY or section compared to the tested variant is allowed as long as the thermal influences of the adjacent units are not more severe.		N/A
	Thermal tests performed on 3-phase, 3-wire ASSEMBLIES are considered as representing 3-phase, 4-wire and single-phase, 2-wire or 3-wire ASSEMBLIES, provided that the neutral conductor is sized equal to or greater than the phase conductors arranged in the same manner.		N/A
10.10.3.3	**Busbars**		N/A
	Ratings established for aluminium busbars are valid for copper busbars with the same cross sectional dimensions and configuration.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The ratings of variants not selected for test according to 10.10.2.2.2 are determined by multiplying their cross-section with the current density of a larger cross-section busbar that has been verified by test.		N/A
10.10.3.4	**Functional units**		N/A
	After the critical variants of a group of comparable functional units (see 10.10.2.2.3 a)) have been subjected to a test for verification of temperature rise limits, the actual rated currents of all other functional units in the group are calculated using the results of these tests.		N/A
	For each functional unit tested a de-rating factor (rated current, resulting from the test divided by the maximum possible current of this functional unit, see 10.10.2.2.3 b)) is calculated.		N/A
	The rated current of each non-tested functional unit in the range is the maximum possible current of the functional unit multiplied by the lowest de-rating factor established for the variants tested in the range.		N/A
10.10.3.5	**Functional units – Device substitution**		N/A
	A device may be substituted with a similar device from another series to that used in the original verification, provided that the power loss and terminal temperature rise of the device, when tested in accordance with its product standard, is the same or lower.		N/A
	In addition, the physical arrangement within the functional unit and the rating of the functional unit is maintained.		N/A
10.10.4	**Verification assessment (by calculation)**		N/A
	Determine the approximate air temperature rise inside the enclosure, which is caused by the power losses of all circuits, and compare this temperature with the limits for the installed equipment.		N/A
	Because the actual local temperatures of the current-carrying parts cannot be calculated by these methods, some limits and safety margins are necessary and are included.		N/A
10.10.4.2	**Single compartment assembly with rated current not exceeding 630 A**		N/A
	Verification of the temperature rise of a single compartment ASSEMBLY with the total supply current not exceeding 630 A and for rated frequencies up to and including 60 Hz may be made by calculation if all the following conditions are fulfilled:		—
	a) the power loss data for all built-in components is available from the component manufacturer;		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	b) there is an approximately even distribution of power losses inside the enclosure;		N/A
	c) the rated current of the circuits of the ASSEMBLY as verified (see 10.10.1) does not exceed 80 % of the rated conventional free air thermal current (I_{th}) if any, or the rated current (I_n) of the switching devices and electrical components included in the circuit. Circuit protection devices shall be selected to ensure adequate protection to outgoing circuits, e.g. thermal motor protection devices at the calculated temperature in the ASSEMBLY;		N/A
	d) the mechanical parts and the installed equipment are so arranged that air circulation is not significantly impeded;		N/A
	e) conductors carrying currents in excess of 200 A, and the adjacent structural parts are so arranged that eddy-current and hysteresis losses are minimised;		N/A
	f) all conductors have a minimum cross-sectional area based on the current rating of the functional unit according to IEC 60364-5-52. Examples on how to adapt this standard for conditions inside an ASSEMBLY are given in the tables included in Annex H. Where the device manufacturer specifies a conductor with a larger cross sectional area this is used;		N/A
	g) the temperature rise depending on the power loss installed in the enclosure for the different installation methods (e.g. flush mounting, surface mounting), is: – available from the enclosure manufacturer; – determined in accordance with 10.10.4.2.2; or – in accordance with performance and installation criteria from the cooling equipment manufacturer when active cooling (e.g. forced cooling, internal air conditioning, heat exchanger etc.) is incorporated.		N/A
	The effective power losses of all circuits including interconnecting conductors are calculated based on maximum load currents of the circuits.		N/A
	The total power loss of the ASSEMBLY is calculated by adding the power losses of the circuits taking additionally into account that the total load current is limited to the rated current of the ASSEMBLY.		N/A
	The power losses of the conductors are determined by calculation (see Annex H).		N/A
10.10.4.2.2	**Determination of the power loss capability of an enclosure by test**		N/A
	The power loss is simulated by means of heating resistors that produce heat equivalent to the intended power loss capability of the enclosure.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The heating resistors are distributed evenly over the height of the enclosure and installed in suitable places inside the enclosure.		N/A
	The cross-section of the leads to these resistors are such that no appreciable amount of heat is conducted away from the enclosure.		N/A
	The test is carried out in accordance with 10.10.2.3.1 –10.10.2.3.4 and the air temperature rise is measured in the top of the enclosure.		N/A
	Enclosure temperatures do not exceed the values given in Table 6.		N/A
10.10.4.2.3	**Results to be obtained**		N/A
	The ASSEMBLY is verified if the air temperature determined from the calculated power loss does not exceed the permissible operating air temperature as declared by the device manufacturer.		N/A
	This means for switching devices or electrical components in the main circuits that the continuous load does not exceed its permissible load at the calculated air temperature and not more than 80 % of its rated current		N/A
10.10.4.3	**ASSEMBLY with rated current not exceeding 1 600 A**		N/A
10.10.4.3.1	**Verification method**		N/A
	Verification of the temperature-rise of a multiple compartment ASSEMBLY with the total supply current not exceeding 1 600 A and for rated frequencies up to and including 60 Hz, may be made by calculation in accordance with the method of IEC 60890 if all the following conditions are fulfilled:		—
	a) the power loss data for all built-in components is available from the component manufacturer;		N/A
	b) there is an approximately even distribution of power losses inside the enclosure;		N/A
	c) the rated current of the circuits of the ASSEMBLY as verified (see 10.10.1) do not exceed 80 % of the rated conventional free air thermal current (Ith) if any, or the rated current (In) of the switching devices and electrical components included in the circuit.		N/A
	d) the mechanical parts and the installed equipment are so arranged that air circulation is not significantly impeded;		N/A
	e) conductors carrying currents in excess of 200 A, and the adjacent structural parts are so arranged that eddy-current and hysteresis losses are minimised;		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	f) all conductors have a minimum cross-sectional area based on the current rating of the functional unit according to IEC 60364-5-52. Examples on how to adapt this standard for conditions inside an ASSEMBLY are given in the tables included in Annex H.		N/A
	Where the device manufacturer specifies a conductor with a larger cross sectional area this conductor is used;		N/A
	g) for enclosures with natural ventilation, the cross section of the air outlet openings is at least 1,1 times the cross section of the air inlet openings;		N/A
	h) there are no more than three horizontal partitions in the ASSEMBLY or a section of an ASSEMBLY;		N/A
	i) for enclosures with compartments and natural ventilation the cross section of the ventilating openings in each horizontal partition is at least 50 % of the horizontal cross section of the compartment.		N/A
	The effective power losses of all circuits including interconnecting conductors are calculated based on maximum load currents of the circuits.		N/A
	The total power loss of the ASSEMBLY is calculated by adding the power losses of the circuits taking additionally into account that the total load current is limited to the rated current of the ASSEMBLY.		N/A
	The power losses of the conductors are determined by calculation (see Annex H).		N/A
	The temperature rise within the ASSEMBLY is then determined from the total power loss using the method of IEC 60890.		N/A
10.10.4.3.2	**Results to be obtained**		N/A
	The ASSEMBLY is verified if the calculated air temperature at the mounting height of any device does not exceed the permissible ambient air temperature as declared by the device manufacturer.		N/A
	Switching devices or electrical components in the main circuits that the continuous load do not exceed its permissible load at the calculated local air temperature and not more than 80 % of its rated current		N/A
10.11	**Short-circuit withstand strength**		N/A
10.11.1	**General**		N/A
	The short-circuit withstand strength declared is verified. Verification may be by the application of design rules, by calculation or by test.		N/A
10.11.2	**Circuit of ASSEMBLIES which are exempted from the verification of the short-circuit withstand**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The verification of short-circuit withstand strength is not required in the following cases:		N/A
	a) for assemblies having I_{cw} or I_{cc} ≤ 10 kA;		N/A
	b) for assemblies protected by current-limiting devices having a cut-off current ≤ 17 kA at max. prospective short-circuit current at the incoming terminals of the assembly;		N/A
	c) for auxiliary circuits of the assembly connected to transformer whose short-circuit impedance is ≥ 4 % and whose rated power is: ≤ 10 kVA for $U_{n\ second}$ ≥ 100 V; or ≤ 1,6 kVA for $U_{n\ second}$ < 110 V;		N/A
	All other circuit shall be verified;		N/A
10.11.3	**Verification by comparison with a reference design – Utilising a check list**		N/A
	Verification by the application of design rules is undertaken by comparison of the assembly to be verified with an already tested design using the check list provided in Table 13.		N/A
10.11.4	**Verification by comparison with a reference design – Utilising a check list**		N/A
	Assessment of the rated short-time withstand current of an ASSEMBLY and its circuits, by calculation and the application of design rules, is undertaken by a comparison of the ASSEMBLY to be assessed with an ASSEMBLY or an ASSEMBLY module, already verified by test.		N/A
	The assessment is in accordance with IEC/TR 61117.		N/A
	In addition each of the circuits of the ASSEMBLY to be assessed meets the requirements of items 6, 8, 9 and 10 in Table 13.		N/A
	The data used, calculations made and comparison undertaken are recorded.		N/A
10.11.5	**Verification by test**		N/A
10.11.5.1	**Test arrangements**		N/A
	The ASSEMBLY or its parts as necessary to complete the test are mounted as in normal use.		N/A
	It is sufficient to test a single functional unit if the remaining functional units are of the same construction.		N/A
	Similarly it is sufficient to test a single busbar configuration if the remaining busbar configurations are of the same construction.		N/A
10.11.5.2	**Performance of the test – General**		N/A
	If the test circuit incorporates fuses, fuse-links with the maximum let-through current and, if required, of the type indicated by the original manufacturer as being acceptable, they are used.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The supply conductors and the short-circuit connections required for testing the ASSEMBLY have sufficient strength to withstand short-circuits and be so arranged that they do not introduce any additional stresses on the ASSEMBLY.		N/A
	Unless otherwise agreed, the test circuit is connected to the input terminals of the ASSEMBLY. Three-phase ASSEMBLIES are connected on a three-phase basis.		N/A
	All parts of the equipment intended to be connected to the protective conductor in service, including the enclosure, are connected as follows:		N/A
	1) for ASSEMBLIES suitable for use on three-phase four-wire systems (see also IEC 60038) with an earthed star point and marked accordingly, to the neutral point of supply or to a substantially inductive artificial neutral permitting a prospective fault current of at least 1500 A;		N/A
	2) for ASSEMBLIES also suitable for use in three-phase three-wire as well as on three-phase four-wire systems and marked accordingly, to the phase conductor least likely to arc to earth.		N/A
	The connection mentioned in 1) and 2) include a fusible element consisting of a copper wire of 0,8 mm diameter and at least 50 mm long, or of an equivalent fusible element for the detection of a fault current.		N/A
10.11.5.3	**Testing of main circuits**		N/A
	Circuits are tested with the highest thermal and dynamic stresses that may result from short circuit currents up to the rated values for one or more of the following conditions as declared by the original manufacturer.		N/A
	a). Not dependent upon a SCPD. The ASSEMBLY is tested with the rated peak withstand current and the rated short-time withstand current for the specified duration		N/A
	b). Dependent upon an incoming SCPD included within the ASSEMBLY. The assembly is tested with an incoming prospective short-circuit current for a period time that is limited by the incoming SCPD.		N/A
	c). Dependent upon an upstream SCPD. The ASSEMBLY is tested to the let through values permitted by the upstream SCPD as defined by the original manufacturer.		N/A
	Where an incoming or outgoing circuit includes a SCPD that reduces the peak and/or duration of the fault current, then the circuit is tested allowing the SCPD to operate and interrupt the fault current		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	If the SCPD contains an adjustable short-circuit release, then this is set to the maximum allowed value		N/A
	One of each type of circuit is subject to a short-circuit test		N/A
10.11.5.3.2	**Outgoing circuits**		N/A
	The outgoing terminals of outgoing circuits are provided with a bolted short-circuit connection.		N/A
	When the protective device in the outgoing circuit is a circuit-breaker, the test circuit may include a shunting resistor in accordance with 8.3.4.1.2 b) of IEC 60947-1 in parallel with the reactor used to adjust the short-circuit current.		N/A
	For circuit-breakers having a rated current up to and including 630 A, a conductor 0,75 m in length having a cross-sectional area corresponding to the rated current (see Tables 11 and 12) is included in the test circuit.		N/A
	The switching device is closed and held closed in the manner normally used in service. The test voltage is then applied once and,		N/A
	a) for a time sufficiently long to enable the short-circuit protective device in the outgoing unit to operate to clear the fault and, in any case, for not less than 10 cycles (test voltage duration), or		N/A
	b) in cases where the outgoing circuit does not include a SCPD, for a magnitude and duration as specified for the busbars by the original manufacturer. Testing of outgoing circuits may also result in the operation of the incoming circuit SCPD.		N/A
10.11.5.3.3	**Incoming circuit and main busbars**		N/A
	ASSEMBLIES containing main busbars are tested to prove the short-circuit withstand strength of the main busbars and the incoming circuit including at least one joint where the busbars are intended to be extendable.		N/A
	The short-circuit is placed such that the length of main busbar included in the test is (2 ±0,4) m.		N/A
	For the verification of rated short-time withstand current (see 5.3.5) and rated peak withstand current (see 5.3.4), this distance may be increased and the test conducted at any convenient voltage providing the test current is the rated value		N/A
	Where the design of the ASSEMBLY is such that the length of the busbars to be tested is less than 1,6 m and the ASSEMBLY is not intended to be extended, then the complete length of busbar is tested, the short-circuit being established at the end of these busbars.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	If a set of busbars consists of different sections (as regards cross-sections, distance between adjacent busbars, type and number of supports per metre), each section is tested separately or concurrently, provided that the above conditions are met.		N/A
10.11.5.3.4	**Connections to the supply side of outgoing units**		N/A
	Where an ASSEMBLY contains conductors between a main busbar and the supply side of outgoing functional units that do not fulfil the requirements of 8.6.4 one circuit of each type is subject to an additional test.		N/A
	A short-circuit is obtained by bolted connections on the conductors connecting the busbars to a single outgoing unit, as near as practicable to the terminals on the busbar side of the outgoing unit. The value of the short-circuit current is the same as that for the main busbars.		N/A
10.11.5.3.5	**Neutral conductor**		N/A
	If a neutral conductor exists within a circuit it is subjected to one test to prove its short-circuit withstand strength in relation to the nearest phase conductor of the circuit under test including any joints.		N/A
	Unless otherwise agreed between the original manufacturer and the User, the value of the test current in the neutral is at least 60 % of the phase current during the three-phase test.		N/A
	The test need not be executed if the test is intended to be made with a current of 60 % of the phase current and if the neutral conductor is:		N/A
	– the same shape and cross- section as the phase conductors		N/A
	– supported in an identical manner as the phase conductors and with support centres along the length of the conductor not greater than that of the phases;		N/A
	– spaced at a distance from the nearest phase(s) not less than that between phases;		N/A
	– spaced at a distance from earthed metalwork not less than the phase conductors.		N/A
10.11.5.5	**Results to be obtained**		N/A
	After the test deformation of busbars and conductors is acceptable provided that the clearances and creepage distances specified in 8.3 are still complied with.		N/A
	The characteristics of the insulation remains such that the mechanical and dielectric properties of the equipment satisfy the requirements of the relevant ASSEMBLY standard.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	A busbar insulator or support or cable restraint has not separated into two or more pieces.		N/A
	There are no cracks appearing on opposite sides of a support and no cracks, including surface cracks, running the full length or width of the support.		N/A
	There are no loosening of parts used for the connection of conductors and the conductors are not separated from the outgoing terminals.		N/A
	Distortion of the busbars or structure of the ASSEMBLY that impairs its normal use are a failure.		N/A
	Any distortion of the busbars or structure of the ASSEMBLY that impairs normal insertion or removal of the removable parts is a failure.		N/A
	Deformation of the enclosure or of the internal partitions, barriers and obstacles due to short-circuit is permissible to the extent that the degree of protection is not impaired and the clearances or creepage distances are not reduced to values, which are less than those specified		N/A
	Additionally after the tests incorporating short-circuit protective devices, the tested equipment is capable of withstanding the dielectric test at a value of voltage for the “after test” condition prescribed in the relevant short-circuit protective device standard for the appropriate short-circuit test, as follows:		N/A
	a) between all live parts and the exposed conductive parts of the ASSEMBLY, and		N/A
	b) between each pole and all other poles connected to the exposed conductive parts of the ASSEMBLY.		N/A
	If tests a) and b) above are conducted, they are carried out with any fuses replaced and with any switching device closed.		N/A
	The fusible element (see 10.11.5.2.), if any, does not indicate a fault current.		N/A
10.11.5.6	**Testing of the protective circuit**		N/A
	A single-phase test supply is connected to the incoming terminal of one phase and to the terminal for the incoming protective conductor.		N/A
	When the ASSEMBLY is provided with a separate protective conductor, the nearest phase conductor is used.		N/A
	For each representative outgoing unit, a separate test is made with a bolted short-circuit connection between the corresponding outgoing phase terminal of the unit and the terminal for the relevant outgoing protective conductor.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Each outgoing unit on test is fitted with its intended protective device. Where alternative protective devices can be incorporated in the outgoing unit, the protective device which lets through the maximum values of peak current and I^2t is used.		N/A
	For this test, the frame of the ASSEMBLY is insulated from earth. The test voltage is equal to 1,05 times the single-phase value of the rated operational voltage.		N/A
	Unless otherwise agreed between the original manufacturer and the user, the value of the test current in the protective conductor is at least 60 % of the phase current during the three-phase test of the ASSEMBLY.		N/A
	All other conditions of this test are analogous to 10.11.5.2 to 10.11.5.4 inclusive.		N/A
10.11.5.6.2	**Results to be obtained**		N/A
	The continuity and the short-circuit withstand strength of the protective circuit, whether it consists of a separate conductor or the frame, are not significantly impaired.		N/A
	Besides visual inspection, this may be verified by measurements with a current in the order of the rated current of the relevant outgoing unit.		N/A
10.12	**ELECTROMAGNETIC COMPATIBILITY (EMC)**		N/A
	For EMC tests, see J.10.12.		N/A
10.13	**MECHANICAL OPERATION**		N/A
	This verification test is not made on such devices of the ASSEMBLY which have already been type tested according to their relevant product standard unless their mechanical operation is impaired by their mounting.		N/A
	For parts, which need verification by test, satisfactory mechanical operation is verified after installation in the ASSEMBLY. The number of operating cycles is 200.		N/A
	At the same time, the operation of the mechanical interlocks associated with these movements is checked.		N/A
	The test is passed if the operating conditions of the apparatus, interlocks, specified degree of protection etc., have not been impaired and if the effort required for operation is practically the same as before the test.		N/A
	In the case of withdrawable parts, the operating cycle includes any physical movements from the connected to the isolated position and back to the connected position.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	ANNEX J: ELECTROMAGNETIC COMPATIBILITY (EMC)		N/A
	The requirements of this section do not apply to the product in question		-
	ANNEX K: PROTECTION BY ELECTRICAL SEPARATION		N/A
	The requirements of this section do not apply to the product in question		-

Attachment No.: 1

Summary of testing:			P
Clouse	**Test**	**Product object No.**	**Comply**
5	Interface characteristics	1, 2	P
6	Information	1, 2	P
7	Service conditions	1, 2	P
8	Constructional requirements	1 and --- 2)	P
9	Performance requirements	--- 2)	P
10	Design verification	--- 2)	P
10.1	General	--- 2)	P
10.2	Strength of materials and parts	--- 1)	P
10.2.1	General	--- 1)	P
10.2.2	Resistance to corrosion	--- 1)	P
10.2.2.1	Test procedure	--- 1)	P
10.2.2.2	Severity test A	--- 2)	P
10.2.2.3	Severity test B	---	P
10.2.2.4	Results to be obtained	--- 1)	P
10.2.3	Properties of insulating materials	---	P
10.2.3.1	Verification of thermal stability of enclosures	--- 1)	P
10.2.3.2	Verification of resistance of insulating materials to abnormal heat and fire due to internal electric effects	--- 1)	P
10.2.3.101	Dry heat test	--- 2)	P
10.2.3.102	Verification of category of flammability	--- 2)	P
10.2.4	Resistance to ultra-violet (UV) radiation	--- 1)	P
10.2.5	Lifting	---	P
10.2.6	Mechanical impact	--- 1)	P
10.2.7	Marking	--- 1)	P
10.2.101	Verification of mechanical strength	1, 2	P
10.2.101.2	Verification of resistance to static load	1	P
10.2.101.3	Verification of resistance to shock load	1	P
10.2.101.4	Verification of resistance to torsional stress	1	P
10.2.101.5	Verification of impact force withstand	1, 2	P
10.2.101.6	Verification of mechanical strength of doors	--- 2)	P
10.2.101.7	Verification of resistance to axial load of metal inserts in synthetic material	---	N/A

Attachment No.: 1

Summary of testing - continued:

Clouse	Test	Product object No.	Comply
10.2.101.8	Verification of resistance to mechanical shock impacts induced by sharp-edged objects	1	P
10.2.101.9	Test of mechanical strength of the base	1	P
10.3	Degree of protection of ACS ASSEMBLIES	---1)	P
10.4	Clearances and creepage distances	---	P
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	---	N/A
10.8	Terminals for external conductors	---	N/A
10.9	Dielectric properties	--- 1)	P
10.10	Verification of temperature rise	---	N/A
10.11	Short-circuit withstand strength	---	N/A
10.12	Electromagnetic compatibility (EMC)	---	N/A
10.13	Mechanical operation	---	N/A
Annex J		---	N/A
Annex K		---	N/A

Note:
1) Evaluation based on reports of the studies included in Appendix No. 4,
2) Evaluation based on reports of the studies included in Appendix No. 5.

Attachment No.: 2

List of test equipment used:

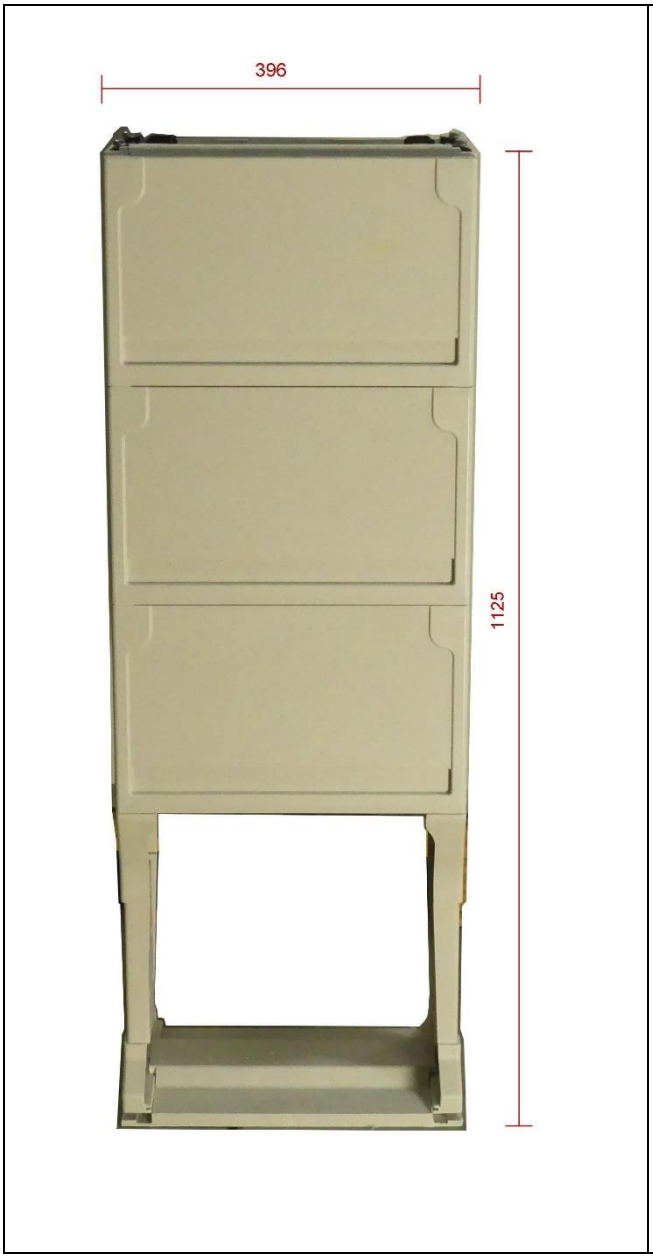
Clause	Measurement/ testing	Testing/measuring equipment/ material used	Range used	Calibration date
10.2.101.2	Verification of resistance to static load	thermohygrometer W-02506	temp. and RH	2021-11-03
		electronic stop watch W-52162	5 min, 1 h	2021-10-15
		tape measure W-52157	3 m	2014-01-14
		weighbridge 801/2713	to 150 kg	2021-01-11
		set of weights W-52149	0,5 kg … 10 kg	2013-04-04
		climatic chamber 801/02724	ºC	2019-09-26
		dynamometer FB200 W-2548	od 0 N do 5 N	2019-03-05
		test wire W-52200	cross-section: 1 mm	2019-01-16
		dynamometer FB200 W-2548	from 0 N to 5 N	2019-03-05
10.2.101.3	Verification of resistance to shock load	thermohygrometer W-02506	temp. and RH	2021-11-03
		tape measure W-52157	3 m	2014-01-14
		bag with dry sand 801/50607/15	mass 15 kg	---
10.2.101.4	Verification of resistance to torsional stress	thermohygrometer W-02506	temp. and RH	2021-11-03
		electronic stop watch W-52162	1/2 min	2021-10-15
		horizontally rotatable frame 801/50607/12	60 mm x 60 mm x 5 mm	---
		dynamometer FB200 W-2548	from 0 N to 5 N	2019-03-05
		test wire W-52200	cross-section: 1 mm	2019-01-16
		dynamometer FB10K 801/02722	od 0 kN do 10 kN	2020-04-07
10.2.101.5	Verification of impact force withstand	thermohygrometer W-02506	temp. and RH	2021-11-03
		electronic stop watch W-52162	5 min, 1 h	2021-10-15
		dynamometer FB200 W-2548	od 0 N do 5 N	2019-03-05
		test wire W-52200	cross-section: 1 mm	2019-01-16
		solid steel ball 801/50607/4	2 kg mass, raised 1 m	---
		climatic chamber 801/02724	-25 ºC, 12 h	2019-09-26

Attachment No.: 2

10.2.101.8	Verification of resistance to mechanical shock impacts induced by sharp-edged objects	thermohygrometer W-02506	temp. and RH	2021-11-03
		electronic stop watch W-52162	5 min, 1 h	2021-10-15
		sharp-edged objects 801/50607/5	5 kg, 0.4 m	---
		climatic chamber 801/02724	-25 ºC, 12 h	2019-09-26
		electronic caliper 8/02644	0 mm … 150 mm	2021-01-18
		dynamometer FB200 W-2548	from 0 N to 5 N	2019-03-05
10.2.101.9	Test of mechanical strength of the base	thermohygrometer W-02506	temp. and RH	2021-11-03
		electronic stop watch W-52162	1 min	2021-10-15
		steel tubes 801/50607/9	F = 3,5 N/mm x L, for 1 min.	---
		weighbridge 801/2713	to 150 kg	2021-01-11
		set of weights W-52149	0,5 kg … 10 kg	2013-04-04
		dynamometer FB200 W-2548	from 0 N to 5 N	2019-03-05
		test wire W-52200	cross-section: 1 mm	2019-01-16

Attachment No.: 3

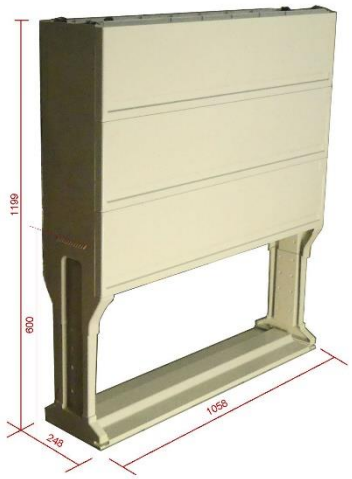
The photos of the tested product :



Attachment No.: 3

The enclosure made of thermosetting insulation material type OS 40 x 80 SK + foundation type FMN-40 – product object marked with No. 1

Attachment No.: 3



Foundation made of thermosetting insulating material of the type: FWN -106 - product object marked with number 2