Prüfbericht-Nr.: *Test report no.:*	**CN23HSEJ 001**	**Auftrags-Nr.:** *Order no.*:	**244385609**	Seite 1 von 94 *Page 1 of 94*
Kunden-Referenz-Nr.: *Client reference no.:*	**40920510**	**Auftragsdatum:** *Order date:*	2022-11-10	
Auftraggeber: *Client:*	**Autel Digital Power Co., Ltd.** Floors 1, 2, 3 and 6, Caihong Keji Building, 36 Hi-tech North Six Road, Songpingshan Community, Xili Sub-district, Nanshan District, Shenzhen City			
Prüfgegenstand: *Test item:*	Low Voltage Switchgear Assemblies			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	EF120A3001			
Auftrags-Inhalt: *Order content*:	Type test			
Prüfgrundlage: *Test specification:*	EN IEC 61439-7-2020			

Wareneingangsdatum: *Date of sample receipt:*	2022-12-09
Prüfmuster-Nr.: *Test sample no:*	#01
Prüfzeitraum: *Testing period:*	2022-12-09 - 2023-02-28
Ort der Prüfung: *Place of testing:*	Guang'an Electrical Testing Center(Guangdong) Co.,LTD
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shanghai) Co., Ltd.
Prüfergebnis*: *Test result*:*	Pass

geprüft von:
reviewed by:

Felix Qi Tonghui Wu

Signed by: Felix Qi (Trainee)
Signed by: Tonghui Wu (Trainer)

Datum:
Date: 2023-03-17

Stellung / *Position:* Project Engineer

genehmigt von:
authorized by:

Wencai Zhang

Signed by: Wencai Zhang

Ausstelldatum:
Issue date: 2023-03-17

Stellung / *Position:* Authorizer

Sonstiges / *Other:*

This report is created with TRF No. IEC61439_7B.
All test items passed.

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Test Report issued under the responsibility of:

TÜVRheinland®

TEST REPORT
IEC 61439-7
Low-voltage switchgear and controlgear assemblies - Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations

Report Number. ..... :	**CN23HSEJ 001**
Date of issue ..... :	**See cover page**
Total number of pages ..... :	**See cover page**
Name of Testing Laboratory preparing the Report ..... :	**TUV Rheinland (Shanghai) Co., Ltd.**
Applicant's name ..... :	Autel Digital Power Co., Ltd.
Address ..... :	Floors 1, 2, 3 and 6, Caihong Keji Building, 36 Hi-tech North Six Road, Songpingshan Community, Xili Sub-district, Nanshan District, Shenzhen City
Test specification:	
Standard ..... :	IEC 61439-7:2018 for use in conjunction with IEC 61439-1:2011
Test procedure ..... :	Type test
Non-standard test method ..... :	N/A
TRF template used ..... :	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No. ..... :	IEC61439_7B
Test Report Form(s) Originator .... :	VDE Prüf- und Zertifizierungsinstitut GmbH
Master TRF ..... :	Dated 2022-05-23

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved IECEE Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing NCB. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description ..... :	Low-voltage Switchgear Assemblies
Trade Mark(s) ..... :	AUTEL
Manufacturer ..... :	Autel Digital Power Co., Ltd.
Model/Type reference ..... :	EF120A3001
Ratings ..... :	See page 7

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	~~CB~~ Testing Laboratory:	Guang'an Electrical Testing Center(Guangdong) Co.,LTD	
Testing location/ address.....:		No.68 XiHu East Road, ShiLong Town, Dongguan City, Guangdong	
Tested by (name, function, signature).....:		See cover page	
Approved by (name, function, signature)...:		See cover page	
☐	Testing procedure: CTF Stage 1:		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	Testing procedure: CTF Stage 2:		
Testing location/ address.....:			
Tested by (name + signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature)...:			
☐	Testing procedure: CTF Stage 3:		
☐	Testing procedure: CTF Stage 4:		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature)...:			
Supervised by (name, function, signature) :			

List of Attachments (including a total number of pages in each attachment):
Attachment 1: Photo documentation – 1 page

Summary of testing:
Based on type designation in the general information of product, test sequences see below.

Tests performed (name of test and test clause):	**Testing location:**
All test items passed.	**Guang'an Electrical Testing Center(Guangdong) Co.,LTD**

Summary of compliance with National Differences (List of countries addressed):

☒ **The product fulfils the requirements of ____EN IEC 61439-7-2020 _____ (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)**

Use of uncertainty of measurement for decisions on conformity (decision rule):

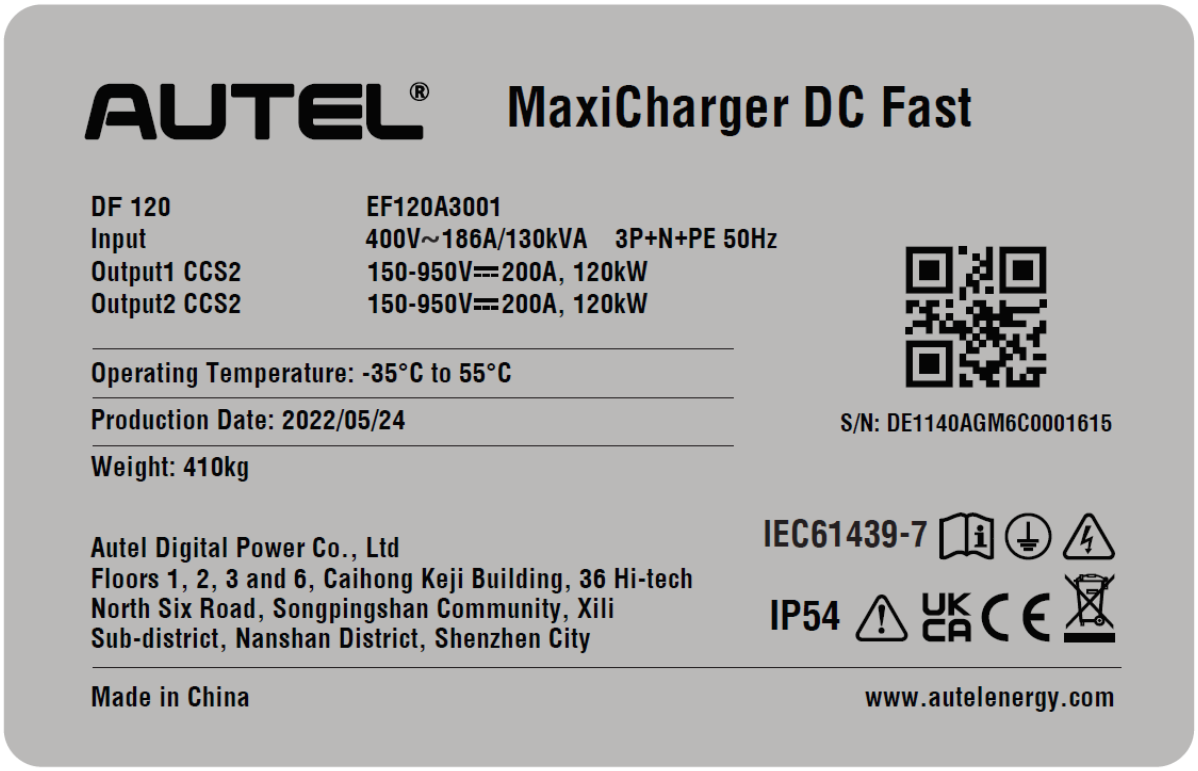
☐ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method").

☐ Other: (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

Information on uncertainty of measurement:
The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.
IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.
Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

Copy of marking plate:

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



Test item particulars.....:	Low-voltage Switchgear Assemblies
Classification of installation and use.....:	Outdoor installation
Supply Connection.....:	Fixed wiring
.....:	
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item .....:	09.12.2022
Date (s) of performance of tests.....:	09.12.2022 to 28.02.2023

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

☐ **This Test Report Form contains requirements according to IEC/ISO Standard dated and includes** Corrigendum dated
(Note: The above text maybe removed if not applicable)

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

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

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

Name and address of factory (ies).....:	Autel Digital Power Co., Ltd. Guangming Branch Room 602, 6th Floor, Electron Factory Building 4, Yanxiang Science & Technology Industrial Park, Gaoxin Road, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, China

General product information and other remarks:

Ue: 400VAC
Ui: 400V
Uimp: 4kV
fn: 50Hz
InA: 186A
Icw: 3,6kA/1s
Outdoor
IP54
IK10

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
5	**INTERFACE CHARACTERISTICS**		—
5.2	**Voltage ratings**		P
	Rated voltage (Un) (of the assembly)	400VAC	P
	Rated operational voltage (Ue) ..... (of a circuit of an assembly)	400VAC	P
	Rated insulation voltage (Ui) ..... (of a circuit of an assembly)	400V	P
	Rated impulse withstand voltage (Uimp) ..... (of the assembly)	4kV	P
5.3	**Current ratings**		—
	Rated current of the assembly (InA)	186A	P
	Rated current of a circuit (Inc)	186A	P
	Rated current of a circuit (Ing)	186A	P
	Rated peak withstand current (Ipk)	5,4kA	P
	Rated short-time withstand current (Icw) ..... (of a circuit of an assembly)	3,6kA, 1s for main busbar	P
	Rated conditional short-circuit current of an assembly (Icc)	3,6kA	P
5.4	**Rated diversity factor (RDF)**		—
	Values of assumed loading		N/A
	Main circuits / Loading factor		N/A
	2 and 3 / 0,8		N/A
	4 and 5 / 0,7		N/A
	6 to 9 inclusive / 0,6		N/A
	10 or more / 0,5		N/A
	Does not apply for AEVCS		N/A
5.5	**Rated frequency (fn)**	50Hz	—
5.6	**Other characteristics**		—
	a) additional requirements depending on the specific service conditions of a functional unit (e.g. type of coordination, overload characteristics);		P
	b) pollution degree of the macro environment	3	P
	c) types of system earthing for which the assembly is designed.....	TN-S	P
	d) indoor and/or outdoor installation.....	outdoor	P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	e) stationary or movable	stationary	P
	f) degree of protection.....	IP54	P
	g) intended for use by ordinary persons	see 3.7.14 IEC 61439-1:2011	P
	h) electromagnetic compatibility (EMC) classification		N/A
	i) special service conditions, if applicable		N/A
	j) external design.....	Enclosed	P
	k) mechanical impact protection, if applicable	IK10	P
	l) the type of construction - fixed, removable or withdrawable parts	fixed	P
	m) the nature of short-circuit protective device(s)...	Circuit breaker	P
	n) measures for protection against electric shock ..	Class I	P
	o) overall dimensions (including projections e.g handles, covers, doors)	Height× Width× Depth: 1950mmx820mmx600mm	P
	p) the weight.....	410kg	P
	q) locations with restricted access or non-restricted access (see 3.5.704 and 3.5.705)		P
5.701	**According to the method of mounting**		—
5.701.1	Stationary ASSEMBLY		P
5.701.1.1	Ground and floor mounted ASSEMBLY		P
5.701.1.2	Wall mounted ASSEMBLY		N/A
5.701.2	Transportable ASSEMBLY		N/A
5.701.3	Mobile ASSEMBLY		N/A
5.702	**According to the mechanical resistance for stationary ASSEMBLY**		—
5.702.1	Basic resistance		N/A
5.702.2	Medium resistance		N/A
5.702.3	High resistance		P
6	**INFORMATION**		—
6.1	**Assembly designation marking**		P
	The following information regarding the ASSEMBLY is provided on the designation label(s):		P
	a) ASSEMBLY manufacturer's name or trade mark (see 3.10.2 IEC 61439-1:2011);		P
	b) type designation or identification number or any other means of identification, making it possible to obtain relevant information from the ASSEMBLY manufacturer		P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	c) means of identifying date of manufacture;		P
	d) IEC 61439-7		P
	e) frequency in the case of AC		P
	f) rated voltage (Un) of the ASSEMBLY		P
	g) rated current of the ASSEMBLY (InA)		P
	h) degree of protection;		P
	i) the weight, for transportable and mobile ASSEMBLIES, where it exceeds 30 kg.		P
6.2	**Documentation**		—
6.2.1	**Information relating to the ASSEMBLY**		—
	ASSEMBLY manufacturer's technical documentation		
	a) rated operational voltage (Ue) of a circuit	400VAC	P
	b) rated impulse withstand voltage (Uimp)	4kV	P
	c) rated insulation voltage (Ui)	400V	P
	d) rated current of each circuit (Inc)	186A	P
	e) rated frequency (fn)	50Hz	P
	f) rated diversity factor(s) (RDF)	1	P
	g) all necessary information relating to the other declared classifications and characteristics		P
	h) overall dimensions	Height× Width× Depth: 1950mmx820mmx600mm	P
	i) ACCS (3.1.701)		N/A
	ACCS (3.1.702)		N/A
	AMPS (3.1.703)		N/A
	AEVCS (3.1.704) or		P
	equivalent terms		P
	j) for mobile ASSEMBLIES according 3.5.704, the mounting position during operation, if necessary		N/A
6.2.2	**Instructions for handling, installation, operation and maintenance**		—
	The assembly manufacturer provides in documents or catalogues:		P
	the conditions, if any, for the handling, installation, operation and maintenance of the assembly and the equipment contained therein. Where appropriate, instructions shall state that the assembly manufacturer is to be consulted when repair of an assembly is required.		P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	the proper and correct transport, handling, installation and operation of the assembly.		P
	The provision of weight details in connection with the transport and handling of transport units. In addition, installation instructions shall provide sufficient details for the installer to adequately secure the assembly in service.		P
	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 transport unit has to be handled.		P
	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		N/A
	If the circuitry within the assembly is not obvious, for example, there are connections from several incoming power-supplies such as photovoltaic supplies, generators, batteries, information detailing the circuit arrangements shall be supplied.		N/A
	When fuses are installed, the assembly manufacturer shall state the type and rating of the fuse-links to be used.		N/A
6.3	**Device and/or component identification**		—
	Inside the assembly, it is possible to identify individual circuits and their protective devices.		P
	Identification tags are legible, permanent and appropriate for the physical environment.		P
	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.		P
7	**SERVICE CONDITIONS**		—
7.1	**Normal service conditions**		—
7.1.1	**Climatic conditions**		—
7.1.2	**Pollution degree**		—
	The pollution degree refers to the macro-environmental conditions for which the assembly is intended.	3	P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
7.2	**Special service conditions**		—
	Where any special service conditions exist, the applicable particular requirements are met or special agreements are made between the assembly manufacturer and the user.		N/A
	a) values of temperature, relative humidity and/or altitude differing from those specified in 7.1;		N/A
	b) applications where variations climatic conditions are likely to result in exceptional condensation inside the assembly;		N/A
	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 current;		N/A
	m) exposure to radiation (for example, X-rays, microwave, ultraviolet other than solar, lasers).		N/A
7.3	**Conditions during transport, storage and installation**		—
	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.		N/A
8	**CONSTRUCTIONAL REQUIREMENTS**		—
8.1	**Strength of materials and parts**		—

IEC 61439-7			
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**		—
	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.		P
8.1.3.	**Properties of insulating materials**		—
8.1.3.1	**Thermal stability**		—
	Enclosures or parts of enclosures made of insulating material(s), not already certified to their own product standard, e.g. louvers, meshes, are capable of operation at temperatures of at least 70 ºC.. Thermal stability is verified according to 10.2.3.1.		N/A
8.1.3.2	**Resistance of insulating materials to heat and fire**		—
8.1.3.2.2	**Resistance of insulating materials to heat**		—
	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.		P
8.1.3.2.3	**Resistance of insulating materials to abnormal heat and fire due to internal electric effects**		—
	Insulating materials used for parts necessary to retain current carrying parts in position and parts which can be exposed to thermal stresses due to internal electrical effects, and the deterioration of which can impair the safety of the assembly, are not adversely affected by abnormal heat and fire and are verified by the glow- ire test in 10.2.3.3. For the purpose of this test, a protective conductor (PE) is not considered as a current-carrying part.		P
8.1.4	**Resistance to ultra-violet radiation**		—
	External surfaces made of insulating materials which are intended to be used outdoor, resistance to ultra-violet radiation is verified according to 10.2.4.		P
8.1.5	**Mechanical strength**		—

IEC 61439-7			
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 (see also 10.2.8), and during short-circuit conditions (see also 10.13).		P
	The mechanical operation of removable parts, including any insertion interlock, is verified by test according to 10.13.		N/A
8.1.7	**Lifting provision**		—
	Where lifting, other than by manual means is recommended by the manufacturer, e.g. by crane or fork lift truck, transport units are provided with the appropriate provision for lifting. Compliance is checked according to the test of 10.2.5.		P
8.2	**Degree of protection provided by an assembly enclosure**		—
8.2.1	**Protection against mechanical impact**		—
8.2.1.701	**ASSEMBLIES for locations with restricted access**		—
	The minimum mechanical resistance for ASSEMBLIES for locations with restricted access is the basic resistance		N/A
	Medium or high resistance (5.702.2 and 5.702.3) is also required by the national installation rules.		N/A
8.2.1.702	**ASSEMBLIES for locations with non-restricted access**		—
	The minimum mechanical resistance for ground and floor mounting ASSEMBLIES for locations with non-restricted access is the high resistance		P
	The minimum mechanical resistance for wall mounting ASSEMBLIES for locations with non-restricted access is the high resistance		P
	In case of wall mounting ASSEMBLIES for locations with non-restricted access intended to be installed at a height where the bottom edge of the ASSEMBLIES is more or equal to 0,9 m from the ground or floor, the mechanical resistance can be decreased to medium resistance		P
8.2.2	**Protection against contact with live parts, ingress of solid foreign bodies and liquids**		—
	The degree of protection provided by any assembly against contact with live parts, ingress of solid foreign bodies and liquid is indicated by the IP code according to IEC 60529 and verified according to 10.3		P
	Indoor ASSEMBLY IP41		N/A

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	Outdoor ASSEMBLY IP44		P
	The degree of protection shall be ensured also when the supply cords are plugged into the ASSEMBLY.		P
	Higher IP degree could be required according to the installation requirements		P
	Where the assembly does not have the same IP rating throughout, IP grades of separate parts are:		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	**Degree of protection of removable parts**		—
	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, the assembly manufacturer provides covers or similar will restore the original degree of protection.		N/A
	Shutters are used to provide adequate protection to live parts and are secured to prevent unintentional removal.		N/A
8.2.101	**PSC-assembly with withdrawable parts**		—
	The degree of protection indicated for PSC-assemblies normally applies to the connected position of withdrawable parts. The assembly manufacturer indicates the degree of protection obtained in the other positions and during the transfer between positions.		N/A
	PSC-assemblies with withdrawable parts are designed that the degree of protection applying to the connected position is also maintained in the test and isolated positions and during transfer from one position to another.		N/A
	If, after the removal of a withdrawable part, the original degree of protection is not maintained, the assembly manufacturer provides covers or similar to restore the original degree of protection		N/A
8.3	**Clearances and creepage distances**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	The requirements for clearances and creepage distances are based on the principles of IEC 60664-1 and are intended to provide insulation co-ordination within the installation.		P
	The clearances and creepage distances of equipment that form part of the assembly comply with the requirements of the relevant product standard.		P
	When incorporating equipment into the assembly, the specified clearances and creepage distances are maintained during normal service conditions.		P
	For dimensioning clearances and creepage distances between separate circuits, the highest voltage ratings is used (rated impulse withstand voltage for clearances and rated insulation voltage for creepage distances).		P
	The clearances and creepage distances apply to line to line, line to neutral, and except where a conductor is connected directly to earth, line to earth and neutral to earth.		P
	For bare live conductors and terminations the clearances and creepage distances are at least equivalent to those specified for the equipment with which they are directly associated.		P
	The effect of a short-circuit up to and including the declared rating(s) of the assembly does not reduce permanently the clearances or creepage distances between busbars and/or connections, below the values specified for the assembly. Deformation of parts of the enclosure or of the internal partitions, barriers and obstacles due to a short-circuit do not reduce permanently the clearances or creepage distances below those specified in 8.3.2 and 8.3.3 (see also 10.11.5.5).		P
8.3.2	**Clearances**		—
	The clearances are sufficient to enable the declared rated impulse withstand voltage (Uimp) of a circuit to be achieved. The clearances is as specified in Table 1. If not a design verification test and routine impulse withstand voltage test is carried out in accordance with 10.9.3 and 11.3, respectively.		P
8.3.3	**Creepage distances**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	The original manufacturer selects a rated insulation voltage(s) (Ui) 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 (Ue).		P
	The creepage distances are not less than the associated minimum clearances.		P
8.4	**Protection against electric shock**		—
8.4.2	**Basic protection**		—
	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.		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.		P
	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**		—
	Hazardous live parts are completely covered with insulation that can only be removed by destruction.		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.		P
	Paints, varnishes and lacquers alone are generally not considered to satisfy the requirements for basic insulation.		P
8.4.2.3	**Barriers or enclosures**		—
	Air insulated live parts are inside enclosures or behind barriers. The enclosures or barriers shall provide at least a degree of protection of IP XXB.		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.		P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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.		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.		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 and TN-C-S systems, the PEL, PEM or PEN conductor is not be isolated or switched. In TN-S systems and TN-C-S systems the midpoint and 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
8.4.3	**Fault protection**		—
8.4.3.1	**Installation conditions**		—
	The ASSEMBLY include protective measures and be suitable for installations designed to be in accordance with IEC 60364-4-41 as well as the applicable wiring standards.		P
8.4.3.2	**Requirements for the protective conductor to facilitate automatic disconnection of the supply**		—
	Each assembly has a protective conductor to facilitate automatic disconnection of the supply for:		P
	a) protection against the consequences of faults within the class I assembly;		P
	b) protection against the consequences of faults in external circuits supplied through the class I and class II assembly.		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.4.3.2.2	**Requirements for earth continuity providing protection against the consequences of faults within the class I assembly**		—
	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.		P
	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 conductor providing earth continuity		P
	For the continuity of these connections the following is applied:		P
	a) When a part of the assembly is removed, for example for routine maintenance, the 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 earth continuity if the precautions taken guarantee permanent good conductivity.		P
	Flexible or pliable metal conduits are not used as protective conductors unless they are designed for that purpose.		P
	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 is attached to them except equipment which is part of a PELV or SELV system. .		P
	If devices with a voltage exceeding the limits of PELV or SELV systems, as appropriate 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 Ie of the devices attached., Alternatively if the rated operational current of the attached devices is less than or equal to 16 A, an equivalent electrical connection specifically designed and verified for this purpose is provided (sliding contact, hinges protected against corrosion).		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Exposed conductive parts of a device that cannot be interconnected for earthing continuity by the fixing means of the device are connected to the earthing arrangement of the assembly by a conductor whose cross-sectional area is chosen according to Table 3.		P
	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 the earthing arrangement. 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.		P
	When removable parts are equipped with a metal supporting surface that have suitable conductivity and corrosion resistance , these surfaces are considered sufficient for ensuring earth continuity provided that the pressure exerted on them is sufficiently high.		N/A
8.4.3.2.3	**Requirements for protective conductors providing protection against the consequences of faults in external circuits supplied through the class I or class II assemblies**		—
	A protective conductor within the assembly is so designed that it can withstand the highest thermal and dynamic stresses arising from faults in external circuits supplied through the assembly in its installed location. Conductive structural parts may be used as a protective conductor or a part of it.		P
	In principle, with the exception of the cases mentioned below, protective conductors within an assembly do not include a disconnecting device (switch, disconnector, etc.):		P
	In the run of protective conductors links are permitted which are removable by means of a tool and accessible only to authorized person(s) (these links may be required for certain tests).		P
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
	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 SCPDs that protect the corresponding live conductors (see 10.11.5.6).		P
	For PEL, PEM and PEN conductors, the following additional requirements apply:		P
	– the minimum cross-sectional area is 10 mm2 copper or 16 mm2 aluminium;		P
	– the PEN and PEM conductor has a cross-sectional area not less than that required for a neutral conductor (see 8.6.1);		P
	– the PEN, PEL and PEM conductors need not be insulated within a class I assembly;		P
	– Structural parts are not used as a PEN, PEL and PEM conductor. However, mounting rails according IEC 60947-7-2, Annex A, made of copper or aluminium may be used;		P
	– for certain applications in which the current in the PEN conductor may reach high values, for example large fluorescent lighting installations, a PEN conductor having the same or higher current-carrying capacity as the phase conductors may be necessary, subject to special agreement between the assembly manufacturer and the user.		P
8.4.3.3	**Electrical separation**		—
	Electrical separation of individual circuits is intended to prevent electrical shock through contact with exposed-conductive-parts, which can become live when basic insulation of the circuit fails.		P
8.4.4	**Additional requirements for class II assemblies**		—

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Clause	Requirement + Test	Result - Remark	Verdict
	a) For basic and fault protection, by double or reinforced insulation, the following additional requirements shall be met. The electrical equipment is enclosed in insulating material which is equivalent of double or reinforced insulation. The enclosure carries the symbol  which is visible from the outside of the protected space.		N/A
	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
	c) If an actuator, or similar, 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
	The enclosure or protected space, when the class II 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 is at least the degree of protection IP2XC (IEC 60529)		N/A
	If an external protective PEL, PEM or PEN conductor is passed through the class II assembly, the assembly provides a suitably identified terminal.		N/A
	d) Inside the enclosure or protected space of a class II assembly, the protective conductor (PE, PEL, PEM or PEN conductor) and its terminal are insulated from the live parts and the exposed conductive parts.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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 of at least IPXXB against unintentional contact not only with the accessible live parts, but also with the exposed conductive parts that are only accessible after the door or 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**		—
	If the assembly contains items of equipment that may retain charges after they have been switched off (capacitors banks without internal basic protection, etc.) a warning label 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
	Touch currents are limited because exposed-conductive-parts are effectively connected to the protective conductor. See 10.5.2.		N/A
8.4.6	**Operating and servicing conditions**		—
8.4.6.1	**Devices to be operated or components to be replaced by ordinary persons**		—
	Protection against any contact with live parts is maintained when operating devices or when replacing components.		N/A
	The minimum degree of protection is IPXXC.		N/A
	Openings larger than those defined by degree of protection IP XXC are allowed during the replacement of certain lamps or fuselinks.		N/A
8.4.6.2	**Requirements related to accessibility in service by authorized persons**		—
	If, for reasons of operation, the assembly is fitted with a device permitting authorized persons to obtain access to live parts while the equipment is live (e.g by overriding the interlock or using a tool), the interlock is automatically restored on reclosing the door(s).		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Obstacles may be removed without using a key or tool and are 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 applied		N/A
8.4.6.2.2	**Requirements related to accessibility for inspection and similar operations**		—
	The assembly is constructed in such a way that certain operations can be performed when the assembly is in service and energized.		P
	Such operations may consist of:		P
	– visual inspection of □□switching devices and other apparatus, □□settings and indicators of relays and releases, □□conductor connections and marking;		P
	– 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 maintenance**		—
	To enable maintenance on an isolated functional unit or isolated group of functional units in the assembly, with adjacent functional units or groups still energized, necessary measures are taken.		P
	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:		P
	– 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;		P
	– use of barriers or obstacles designed and arranged to protect against direct contact with equipment in adjacent functional units or groups;		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– 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
8.4.6.2.4	**Requirements related to accessibility for extension when energized**		—
	When it is required to enable future extension of an assembly with additional functional units or groups, with the rest of the assembly still energized, 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 energized.		N/A
	The extension of busbars and connection of additional units to their incoming supply are not made when energized, unless the assembly is designed for this purpose.		N/A
8.5	**Incorporation of switching devices and components**		—
8.5.1	**Fixed parts**		—
	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 energized.		P
	Removal and installation of fixed parts requires the use of a tool.		P
	The disconnection of a fixed part requires the isolation of the complete assembly or part of it.		P
	In order to prevent unauthorized operation, the switching device may be provided with means to secure it in one or more of its positions.		P
8.5.2	**Removable parts**		—
	The removable parts is so constructed that their electrical equipment can be safely removed from, or connected to, the main circuit even if this circuit is live.		N/A
	The removable parts may be provided with an insertion interlock		N/A
	Clearances and creepage distances (see 8.3) are complied with during transfer from one position to another.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	A removable part is fitted with a device that ensures that it can only be removed and inserted after its main circuit has been switched off from the load.		N/A
	If unauthorized operation can occur, then the removable parts are provided with a locking means to secure them in one or more of their positions.		N/A
8.5.3	**Selection of switching devices and components**		—
	Switching devices and components incorporated in assemblies comply with the relevant IEC standards.		P
	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 protective devices with suitable current-limiting characteristics, for example fuses or current limiting circuit-breakers.		P
	When selecting current-limiting protective devices for built-in switching devices, the maximum permissible values specified by the device manufacturer, shall be taken into account with due regard to co-ordination (see 9.3.4).		P
	Co-ordination of switching devices and components, for example co-ordination of motor starters with short-circuit protective devices comply with IEC 60947-4-1.		P
	The need for overvoltage protection (SPDs) conforming to a relevant IEC standard to prevent possible damage to the installation should be considered.		P
8.5.4	**Installation of switching devices and components**		—
	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.		P
	In the case of electronic equipment, this may necessitate the separation or screening of all electronic signal processing circuits.		P
	When fuses are installed the original manufacturer states the type and rating of the fuselinks to be used.		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.5.5	**Accessibility**		—
	Adjusting and resetting devices, which have to be operated inside the assembly are easily accessible.		P
	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.		P
	Assuming the base of the assembly and the normal standing area for operational personnel are at the same level the following accessibility requirements associated with floor-standing assemblies apply:		P
	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.		P
	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.		P
	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.		P
	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		P
8.5.6	**Barriers**		—
	Barriers for manual switching devices are so designed that the switching emissions do not present a danger to the operator.		—
	To minimize danger when replacing fuse-links, interphase barriers are applied, unless the design and location of the fuses makes this unnecessary.		—
8.5.7	**Direction of operation and indication of switching positions**		—
	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.		P
8.5.8	**Indicator lights and push-buttons**		—

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Clause	Requirement + Test	Result - Remark	Verdict
	Unless otherwise specified in the relevant product standard the colours of indicator lights and push-buttons are in accordance with IEC 60073.		N/A
8.5.9	**Power factor correction banks**		—
	For power factor correction banks incorporated in assemblies, the requirements of IEC 61921:2017 are met		N/A
8.6	**Internal electrical circuits and connections**		—
8.6.1	**Main circuits**		—
	The busbars (bare or insulated) are arranged in such a manner that an internal short-circuit is not to be expected.		P
	They are rated at least in accordance with the requirements 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.		P
	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 live parts and/or between live parts and earth is not to be expected (see 8.6.4).		P
	The minimum cross-sectional area of the neutral conductor within a three phase and neutral circuit is:		P
	-For circuits with a line conductor cross-sectional area up to and including 16 mm2, 100 % of that of the corresponding lines.		N/A
	-For circuits with a line conductor cross-sectional area above 16 mm², 50 % of that of the corresponding lines with a minimum of 16 mm2.		P
	It is assumed that the neutral currents do not exceed 50 % of the phase currents.		P
8.6.2	**Auxiliary circuits**		—
	The design of the auxiliary circuits takes into account the auxiliary circuit(s) earthing and ensures that an earth-fault does not cause unintentional dangerous operation.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	In general, auxiliary circuits are protected against the effects of short circuits.		P
	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).		P
8.6.3	**Bare and insulated conductors**		—
	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.		P
	The effects of thermal expansion and of the electrolytic action in the case of dissimilar metals, and the ageing due to the temperatures attained, are taken into consideration		P
	Connections to devices mounted on doors or to other movable parts shall be made using flexible conductors, e.g. Class 5 or Class 6 according to IEC 60228		P
	Connections between current-carrying parts are established by means that ensure a sufficient and durable contact pressure.		P
	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.		P
	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:		P
	– They are rated for at least the rated insulation voltage (see 5.2.3) of the circuit concerned.		P
	– Conductors connecting two termination points have no intermediate joint, e.g. spliced or soldered.		P
	– Conductors with only basic insulation are prevented from coming into contact with bare live parts at different potentials.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– Contact of conductors with sharp edges are prevented.		P
	- 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.		P
	– 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.		P
	– 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 terminal clamping units are designed for this purpose.		P
	Conductors of different circuits may be laid side by side, may occupy the same duct (for example conduit, trunking system), or may be in the same multiconductor cable if the arrangement does not impair the proper functioning of the respective circuits.		P
	In case circuits operate at different voltages, the conductors are separated by suitable barriers.		P
	Alternatively, all conductors within the same duct or any conductors in multicore cables are insulated for the highest voltage to which any conductor within the same duct can be subjected, for example line to line voltage for unearthed systems and line to earth voltage for earthed systems.		N/A
8.6.4	**Selection and installation of non-protected live conductors to reduce the possibility of short-circuits**		—
	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 accordance with Table 4.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Non-protected live conductors selected and installed as in Table 4 and having a SCPD on the load side do not exceed 3 m between the main busbar and each respective SCPD or, in the case of a single section assembly, between the load terminals of the incoming device and the supply terminals of each outgoing SCPD.		P
8.6.5	**Identification of the conductors of main and auxiliary circuits**		—
	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.		P
	Where appropriate, identification according to IEC 60445 and IEC 60446 are applied		P
8.6.6	**Identification of the protective conductor (PE, PEL, PEM, PEN) and of the neutral conductor (N) and the mid-point conductor (M) of the main circuits**		—
	The protective conductor (PE, PEL, PEM or PEN) is readily distinguishable by location and/or marking or colour.		P
	Identification by colour or marking is used in accordance with IEC 60445:2017.		P
	When the protective conductor is an insulated single-core cable, this colour identification is used, preferably throughout the whole length.		P
	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).		P
8.6.7	**Conductors in AC circuits passing through ferromagnetic enclosures or plates**		—
	Where conductors in AC circuits with a current rating exceeding 200 A pass through ferromagnetic material.		N/A
	- be arranged such that the conductors are only collectively surrounded by ferromagnetic material, e.g. pass through the same hole,		N/A
	- arrangement where conductors pass through separate holes is verified by temperature-rise test(s)		N/A
8.7	**Cooling**		—

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Clause	Requirement + Test	Result - Remark	Verdict
	Special precautions required at the place of installation to ensure proper cooling (the assembly manufacturer shall furnish the necessary information) .		N/A
8.8	**Terminals for external conductors**		—
	Based on the information from the original manufacturer, the ASSEMBLY manufacturer indicates whether the terminals are suitable for connection of copper or aluminium conductors, or both.		P
	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.		P
	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).		P
	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.		P
	The conductors are not subjected to stresses		P
	In the absence of a specific information that larger cables are to be used, which require larger terminals, on three-phase and neutral circuits, terminals for the neutral conductor allow the connection of copper conductors having a current-carrying capacity:		P
	– equal to half the current-carrying capacity of the line conductor, with a minimum of 16 mm2, if the size of the line conductor exceeds 16 mm2;		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– equal to the full current-carrying capacity of the line conductor, if the size of the latter is less than or equal to 16 mm2.		P
	If connecting facilities for incoming and outgoing neutral, mid-point, protective, PEL, PEM and PEN conductors are provided; they are arranged in the vicinity of the associated line conductor terminals.		P
	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.		P
	The terminals for external protective conductors are marked according to IEC 60445.		P
	The terminals for external protective conductors (PE, PEL, PEM,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.		P
	A separate terminal of adequate size is provided for the outgoing protective conductor(s) of each circuit.		P
	In the absence of a specific information that larger cables are to be used, which require larger terminals, terminals for protective conductors allow the connection of copper conductors having a cross-section depending on the cross-section of the corresponding line conductors according to Table 5. Terminals for PEN conductors is the same as for neutral conductors.		P
	In the case of enclosures and conductors of aluminium or aluminium alloys, particular consideration are given to the danger of electrolytic corrosion.		P
8.701	**Supports and securing devices of ASSEMBLY**		—
8.701.1	**Handling provisions**		—
	In case of mobile ASSEMBLIES, handles is provided on the ASSEMBLY and be firmly attached to the enclosure or supporting framework.		N/A
	The ASSEMBLY is verified according to 10.2.5.		N/A
8.701.2	**Water and other fluid systems**		—
	The ASSEMBLY in a common enclosure with water and other fluid is designed according to the requirements of this document for outdoor installation.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The compartment containing the fluid system is separated in such way that an improper fluid ingress is prevented.		N/A
	Compliance is checked by inspection.		N/A
	In the case that the fluid system could lead to a risk of explosion, additional requirements may be necessary.		N/A
	Provisions for the using of other fluids could be subject to an agreement between the manufacturer and users.		N/A
8.701.3	**Other services**		—
	Other services is installed in the same enclosure provided that any unacceptable interferences are not created		P
9	**PERFORMANCE REQUIREMENTS**		—
9.1	**Dielectric properties**		—
9.1.2	**Power-frequency withstand voltage**		—
	The circuits of the assembly are capable of withstanding the appropriate power frequency withstand voltages given in Tables 8 and 9. The rated insulation voltage of any circuit of the assembly is equal to or higher than its maximum operational voltage.		P
	Enclosures and external operating handles manufactured from or covered with insulating materials are capable of withstanding the power frequency dielectric tests as given in 10.9.4 and 10.9.5.		P
	Conductors covered with insulating material to provide protection against electric shock are capable of withstanding the power frequency dielectric test as given in 10.9.6. This test is not required for insulated conductors which are verified to be suitably insulated according to their product standard (e.g. cables).		P
9.1.3	**Impulse withstand voltage**		—
9.1.3.1	**Impulse withstand voltages of main circuits**		—
	Clearances from live parts to parts intended to be earthed and between poles are capable of withstanding the test voltage given in Table 10 appropriate to the rated impulse withstand voltage.		P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
9.1.3.2	**Impulse withstand voltages of auxiliary circuits**		—
	a) Auxiliary circuits that are connected to the main circuit and operate at the rated operational voltage without any means for reduction of overvoltage comply with the requirements of 9.1.3.1.		N/A
	b) Auxiliary circuits that are not connected to the main circuit may have an overvoltage withstand capacity different from that of the main circuit. The clearances of such circuits – a.c. or d.c. – are capable of withstanding the appropriate impulse withstand voltage in accordance with Annex G.		N/A
9.1.4	**Protection of surge protective devices**		—
	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.		P
	The installation of the SPD are according the instructions of the SPD manufacturer, for example, the total length of conductors between the terminals of the SPD to the line and earth, as applicable.		P
9.2	**Temperature rise limits**		—
	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.		P
	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.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
9.2.2	**Adjustment of rated currents for alternative ambient air temperatures**		—
	Alternative ambient temperature	—	—
	The rated currents of all busbars, functional units, etc. may need to be changed accordingly. The original manufacturer's measures taken, to ensure compliance with the temperature limits are following		N/A
	If an adaptation for lower ambient air temperatures is made, then the rated currents of the devices published by the device manufacturers are not exceeded.		N/A
9.3	**Short-circuit protection and short-circuit withstand strength**		—
	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**		—
	For assemblies with a SCPD incorporated in the incoming unit, the assembly manufacturer has declared 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 5.3.4, 5.3.5 and 5.3.6). 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

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Clause	Requirement + Test	Result - Remark	Verdict
	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 both of the following ways:		N/A
	a) rated short-time withstand current (Icw) together with the associated duration (see 5.3.5) and rated peak withstand current (Ipk) ((see 5.3.4);		N/A
	b) rated conditional short-circuit current (Icc) (see 5.3.6).		N/A
	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 I2t = constant , provided that the peak value does not exceed the rated peak withstand current.		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, considering all operating modes, in each incoming unit, in each outgoing unit and in the busbars. The prospective short-circuit currents determined is based on data provided by the user.		N/A
9.3.3	**Relationship between peak current and short-time current**		—
	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**		—
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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 SCPD installed in the circuit without affecting the other outgoing circuits, thus ensuring selectivity of the protective system.		N/A
	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 can otherwise be compromised.		N/A
9.4	**Electromagnetic compatibility (EMC)**		—
	For EMC related performance requirements, see J.9.4 of Annex J.		N/A
9.701	**Inrush current withstand strength for AEVCS**		—
	AEVCS intended for AC, the individual switching device withstand an inrush current representing a typical charger of an electric vehicle.		N/A
	If not already tested against this requirement, the individual switching device shall be verified by the tests of Annex CC.		N/A
10	**DESIGN VERIFICATION**		—
	Design verification is intended to verify compliance of the design of an assembly or assembly system with the requirements of this series of standards.		—
	Where tests on the assembly have been conducted in accordance with the IEC 60439 series (withdrawn), or previous editions of the IEC 61439 series, and the test results fulfil the requirements of the current edition of the relevant part of IEC 61439 series, the verification of these requirements need not be repeated.		N/A

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	Repetition of verifications in the product standards of switching devices or components including conductors 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.		P
	Tests on individual devices and components including conductors to their respective product standards are not an alternative to the design verifications in this standard for the assembly.		—
	Modifications on a verified assembly have been checked with Clause 10 and do not affect the performance of the assembly.		N/A
	The tests are performed on a representative sample of an assembly in a clean and new condition		P
	The performance of the assembly may be affected by the verification tests (e.g. short-circuit test). These tests are not performed on an assembly that is intended to be placed in service.		—
	An assembly which is verified in accordance with this standard by an original manufacturer (see 3.10.1) and manufactured or assembled by another does not require the original design verifications to be repeated if all the requirements and instructions specified and provided by the Original Manufacturer are met in full.		P
	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 and is responsible for verification of these alternate arrangements.		P
	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.		P
	The data used, calculations made and comparison undertaken for the verification of assemblies are recorded in a verification report.		P
10.2	**STRENGTH OF MATERIALS AND PARTS**		—
10.2.1	**General**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	Meet requirement	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**		—
	The resistance to corrosion of representative samples of ferrous metallic enclosures and internal and external ferrous metallic parts of the assembly are verified.	Meet requirement	—
	The test are carried out on an enclosure or representative sample showing the same constructional detail as the enclosure itself.	Outdoor installation metal shell sample	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.		P
	Where the enclosure is subjected to the test it is mounted as for normal use according to the original manufacturer's instructions.		P
	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.	Severity test B, as detailed in 10.2.2.3	P
10.2.2.4	**Results to be obtained**		—
	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.	Meet requirement	P
	Compliance is checked by visual inspection to determine that:		—
	– 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;	There is no evidence of iron oxide, cracking or other deterioration	P
	– the mechanical integrity is not impaired;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– seals are not damaged,		P
	– doors, hinges, locks, and fastenings work without abnormal effort.		P
10.2.2.5	**Verification by comparison to reference design**		—
	Enclosures, enclosure parts and internal ferrous metallic parts, irrespective of their shape and size, which are covered by the corrosion test on the representative samples and manufactured from the same materials and with the same surface treatments, using the same manufacturing process.		N/A
10.2.3	**Properties of insulating materials**		—
10.2.3.1	**Verification of thermal stability of enclosures**		—
	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**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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:		—
	a) on parts of assemblies, or		N/A
	b) on specimens taken from these parts.		P
	The test is carried out on material with the minimum thickness used for the parts in a) or b).		P
	The temperature of the tip of the glow-wire is as follows:		—
	– 960 °C for parts necessary to retain current-carrying parts in position;	Busbar clamp, Insulator	P
	- 850 °C for enclosures to be installed in hollow walls;		N/A
	– 650 °C for all other parts, including parts necessary to retain the protective conductor and enclosure parts intended to be embedded in and mounted on walls which are combustion resistant	Insulation baffle	P
	The specimen is considered to have withstood the glow-wire test if		—
	– there is no visible flame and no sustained glowing, or if	No visible flame and no sustained glowing	P
	– 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.	No burning of the tissue paper	P
	For small parts having surface dimensions not exceeding 14 mm × 14 mm, an alternative test may be used (e.g. needle flame test, according to IEC 60695-11-5:2016).		N/A
	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
10.2.3.2.3	As an alternative the original manufacturer may provide data on the suitability of materials from the insulating material manufacturer to demonstrate compliance with IEC 60695-2-12 for the materials used and applicable temperature according to 10.2.3.2.1.		N/A
10.2.4	**Resistance to ultra-violet (UV) radiation**		—

IEC 61439-7			
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	Outdoor installation. Metals that are entirely coated by synthetic materia.	P
10.2.4.1.1	**Verification for enclosures and external parts of assemblies constructed of insulating materials**		—
	Test samples: – six test specimens of standard size according to ISO 178:2010; and – six test specimens of standard size according to ISO 179-1:2010, ISO 179-2:1997 and ISO 179-2:1997/AMD:2011		N/A
	Test sequence:		N/A
	a) UV test according to ISO 4892-2 method A; Cycle 1 providing a total test period of 500 h.		N/A
	b) Verification of the flexural strength is performed in accordance with ISO 178 (method A) with six of the samples. The surface of the sample exposed to UV radiation was face down and the pressure was applied to the non-exposed surface.		N/A
	c) Verification of the Charpy impact is performed in accordance with ISO 179 on the other six samples. No notches are cut into the sample and the impact was applied to the exposed surface.		N/A
	Samples show no cracks or deterioration visible to normal or corrected vision without additional magnification.		N/A
	The flexural strength according to ISO 178 have 70 % minimum retention		N/A
	The Charpy impact according to ISO 179 has 70 % minimum retention.		N/A
	Materials whose impact bending strength could not be determined prior to exposure because no rupture has occurred, not more than three of the exposed test specimens broke.		N/A
10.2.4.1.2	**Verification for enclosures and external parts of assemblies coated on their exposed surface(s) by synthetic material**		—
	Test sample: Three representative samples of suitable size are tested.		P
	UV test performed on all three samples according to ISO 4892-2:2013, Method A, Cycle 1 providing a total test period of 500 h.	Meet requirement	P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	The adherence of the synthetic material has a minimum retention of category 3 according to ISO 2409.	Meet requirement	P
10.2.4.1.3	**Verification by assessment**		—
	As an alternative, the original manufacturer shall provide data on the suitability of materials of the same type and thickness or thinner from the insulating material supplier to demonstrate compliance with the requirements of 8.1.4.		N/A
10.2.5	**Lifting**		—
	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.	1,25*450: 562,5kg	P
	With doors closed it is lifted with the specified lifting means and in the manner defined by the original manufacturer.		P
	From a standstill position, the transport unit 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 transport unit is raised up and suspended clear of the floor for 30 min without any movement.		P
	Following the test the transport unit 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.		P
	After the test, with the test weights in place, the transport unit shows no cracks or permanent distortions visible to normal or corrected vision without additional magnification, which could impair any of its characteristics.	No cracks or permanent distortions visible	P
10.2.5.2	**Verification by comparison to a reference design**		—
	Enclosures with the same or equal constructional design and arrangements for lifting verified by having an equal or lower weight than that tested as the representative sample		N/A
10.2.6	**Verification of protection against mechanical impact (IK code)**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	Mechanical impact tests, where required by the specific assembly standard, are to be carried out in accordance with the test requirements of the specific assembly standard.	IK10	P
10.2.7	**Marking**		—
	Marking made by moulding, pressing, engraving or similar, including labels with a laminated plastic covering, is not submitted to the following test.		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
	Markings which are of same material and method of printing and covered by the tests completed on the reference samples.		N/A
10.2.8	**Mechanical operation**		—
	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 has been modified by their mounting arrangements differing from those given in the device manufacturer's instructions		P
	For parts that need to be verified through testing (see 8.1.5), intended mechanical operation is verified after installation in the assembly. The number of operating cycles is 200	200 times	P
	Where a device has been tested in accordance with its own product standard, but the mounting arrangement is not in accordance with the manufacturer's instructions, the number of operations is in accordance with the product standard.		N/A
	At the same time, the operation of the mechanical interlocks associated with these movements is checked.		P
	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.	Meet requirement	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
	Enclosures with the same or equal constructional solution for mechanical operation and covered by tests completed on the reference samples		P
10.2.701	**Verification of mechanical strength for ASSEMBLIES**		—
10.2.701.1	**General**		—
	Ambient temperature +10 °C - +40 °C.	19,7	P
	New sample ASSEMBLY may be used for each of the independent tests.		P
	ASSEMBLY mounted and installed as for normal use according to the original manufacturer's instructions		P
	Exception of the test of 10.2.701.4, the door(s) of the ASSEMBLY, if applicable, locked at the beginning of the test and remain locked for the duration of the test.		P
10.2.701.2	**Verification of resistance to mechanical impact**		—
	Mechanical impacts carried out in accordance with IEC 62262.	IK10	P
	- Bases as defined in 3.5.707 not subjected to any mechanical tests present in this document.		P
	- Blows not applied on components mounted on or in the surface of the enclosure		P
	- No damage after test	No damage	P
	- Damage to the finish, small dents and small chips which do not adversely affect the protection against electric shock or harmful ingress of water disregarded.		P
	- Cracks passing through the material not visible	No cracks	P
10.2.701.3	**Verification of resistance to static load**		—
	Test 1: an evenly distributed load L1:		P
	– 4 500 N/m2 for medium-resistance ASSEMBLY		N/A
	– 8 500 N/m2 for high-resistance ASSEMBLY	8500N	P
	Test 2: a force F1:		P
	– 600 N for medium resistance ASSEMBLY		N/A
	– 1 200 N for high resistance ASSEMBLY	1200N	P
10.2.701.4	**Verification of mechanical strength of doors**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	The test applies to all types of ground mounted ASSEMBLIES having a door(s) hinged on a vertical edge of the enclosure.		P
	This test does not apply for doors inside the enclosure and for hinged lids inside the enclosure.		P
	Unless the door(s) are designed to be unhinged without the use of a tool for maintenance or operational use, the test repeated with the force F2 increased to		P
	– 250 N for medium resistance ASSEMBLY		N/A
	– 450 N for high resistance ASSEMBLY	450N	P
10.2.701.5	**Verification of resistance to shock load**		—
	Compliance is checked by verification that, after the test, the degree of protection remains in accordance with 8.2.2 and that the operation of the door(s) and locking points are not impaired.	The operation of the door(s) and locking points are not impaired	P
	Detachments, cracks or deterioration of aesthetical parts or components disregarded.		P
10.2.701.6	**Verification of resistance to torsional stress**		—
	The ASSEMBLY, with the door(s) closed have a torsional force of 2 × 1 000 N applied for 30 s	2 × 1 000 N	P
	The load/force applied smoothly without jerks within 30s.	30s	P
	Compliance is checked by verifying that the doors(s) remain closed for the duration of the test and by verification after the test		P
	Detachments, cracks or deterioration of aesthetical parts or components disregarded.	Meet requirement	P
10.2.701.7	**Verification of resistance to mechanical shock impacts induced by sharp edged objects**		—
	Agreement between manufacturers and users		P
	The test carried out using an impact apparatus as described in IEC 60068-2-75		P
	The striker element raised through a height of 0,4 m and allowed to drop and impact the surface of the ASSEMBLY under test, thus providing an impact energy of 20 J.	20 J	P
	Each test consist of one blow aimed at the centre of at least three of the vertical surfaces of the ASSEMBLY which are visible when the ASSEMBLY is installed as for normal use in accordance with the original manufacturer's instructions.		P

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	Blows not applied on components mounted on or in the surface of the enclosure		P
	Test 1 carried out at an ambient air temperature between +10 °C and +40 °C after the ASSEMBLY has been kept within these temperatures for not less than 12 h.	19,7	P
	Test 2 carried out at an ambient air temperature between +10 °C and +40 °C immediately after the ASSEMBLY has been kept at a temperature of −25 −05 °C for a period of not less than 12 h.	19,7	P
	Cracks resulting from the blows are contained within a circle of diameter not exceeding 15 mm.	Meet requirement	P
	If the tip of the striker element has penetrated the enclosure of the ASSEMBLY, it not possible to insert a gauge of 4 mm diameter having a hemispherical tip, applied to the hole with a force of 5 N.		P
10.2.701.8	**Shock test for mobile and transportable ASSEMBLY**		—
	Mobile and transportable ASSEMBLIES subjected to a single pulse half-sine wave, the shock test having a severity of 500 m/s2 (50 g) peak acceleration and a duration of 11 ms.		N/A
	Subject to agreement between manufacturer and user, the test may be carried out at separate sections of the ASSEMBLY.		N/A
	Superficial damage, paint removals, small indentations, cracks not visible with normal or corrected vision without further magnification, or surface cracks shall not constitute failure of the test.		N/A
10.3	**DEGREE OF PROTECTION OF ASSEMBLIES**		—
	The degree of protection provided is verified in accordance with IEC 60529; the test may be carried out on a representative equipped assembly.	IP54	P
	Where an empty enclosure in accordance with IEC 62208 or an assembly enclosure tested in accordance with the IEC 61439 series is used, a verification assessment is 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.	Meet requirement	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	Meet requirement	P
	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 reduce the clearance and creepage distances. If clearances and creepage distances are reduced, they are not below the minimum specified in Table 1 and Table 2,respectively..	Meet requirement	P
10.4	**CLEARANCES AND CREEPAGE DISTANCES**		—
	The clearances are sufficient to enable the declared rated impulse withstand voltage (Uimp) of a circuit to be achieved. Rated impulse withstands voltage.	4kV	P
	Required clearances as specified in Table 1.	See Annex table	P
	Measured clearances	See Annex table	
	The original manufacturer selects a rated insulation voltage(s) (Ui) 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 (Ue). Insulation voltage Ui.....	400V	P
	Pollution degree.	3	P
	Material group	IIIa	P
	Minimum clearances required	See Annex table	P
	The creepage distances measured.....	See Annex table	P
	Where functional units are mounted on withdrawable parts, the isolation provided in the isolated position is at least comply with the requirements in the relevant specification for disconnectors (see IEC 60947-3).		N/A
	The isolating distance between the withdrawable unit main contacts and their associated fixed contacts in the isolated position is capable of withstanding the test voltage for the declared impulse withstand voltage as specified in Table 102.		N/A

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
10.5	**PROTECTION AGAINST ELECTRIC SHOCK AND INTEGRITY OF PROTECTIVE CIRCUITS**		—
10.5.2	**Effective earth continuity between the exposed conductive parts of the class I assembly and the protective circuit**		—
	It is verified that the different exposed conductive parts of the assembly are effectively connected to the terminal for the incoming external protective conductor		P
	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.).		P
	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	Max. 3,74m Ω,	P
10.5.3	**Short-circuit withstand strength of the protective circuit**		—
	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.	See annex	N/A
10.5.3.2	**Protective circuits that are exempted from short-circuit withstand verification**		—
	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**		—
	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**		—
	Verification by comparison with reference designs 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**		—
	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.	Meet Requirement	P

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Clause	Requirement + Test	Result - Remark	Verdict
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 10.12).		N/A
10.7	**INTERNAL ELECTRICAL CIRCUITS AND CONNECTIONS**		—
	Compliance with the design requirements of 8.6 for internal electrical circuits and connections is confirmed by inspection and verified to this standard.	Meet Requirement	P
10.8	**TERMINALS FOR EXTERNAL CONDUCTORS**		—
	Compliance with the design requirements of 8.8 for terminals for external conductors is confirmed by inspection.	Meet Requirement	P
10.9	**DIELECTRIC PROPERTIES**		—
10.9.1	**General**		—
	For this test, all the electrical equipment of the assembly is connected, except those items of apparatus which, according to the relevant specifications, are designed for a lower test voltage; current-consuming apparatus (e.g. windings, measuring instruments, voltage surge suppression devices) in which the application of the test voltage would cause the flow of a current, are disconnected.		P
	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.		P
10.9.2	**Power-frequency withstand voltage**		—
10.9.2.1	**Main and auxiliary circuits**		—
	Main and auxiliary circuits that are connected to the main circuit are subjected to the test voltage according to Table 8.	1890V	P
	Auxiliary circuits, whether a.c. or d.c., that are not connected to the main circuit are subjected to the test voltage according to Table 9.		N/A
10.9.2.2	**Test voltage**		—
	The test voltage has a practically sinusoidal waveform and a frequency equal to the rated frequency of the assembly with a tolerance of ±25 %. A DC test voltage shall have negligible ripple		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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 sufficient to trip the overcurrent relay and it is greater than 100 mA.		P
	The overcurrent relay does not trip when the output current is less than 100 mA.		P
	The value of the test voltage is that specified in Table 8 or 9 as appropriate with a permitted tolerance of □□3 %.		P
10.9.2.3	**Application of the test voltage**		—
	The test 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 60 s as follows:		P
	a) between all live parts of the main circuit connected together (including the 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	1890V	P
	b) between each live part of different potential of the main circuit and, the other live parts of different potential and exposed conductive parts connected together, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link;	1890V	P
	c) between each 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.	The overcurrent relay does not operate and there are no disruptive discharge during the test.	P
10.9.3	**Impulse withstand voltage**		—
10.9.3.1	**General**		—
	Verification shall be made by test or by assessment		P

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Clause	Requirement + Test	Result - Remark	Verdict
	In place of the impulse withstand voltage test of 10.9.3.2 the original manufacturer may perform, at his discretion, an equivalent a.c. or d.c. voltage test, in accordance with 10.9.3.3 or 10.9.3.4, but consideration is given to the fact that such a tests exert a higher stress.		P
10.9.3.2	**Impulse withstand voltage test**		—
	The impulse voltage generator is adjusted to the required impulse voltage with the assembly connected. The value of the test voltage is that specified in 9.1.3. The tolerance of the applied peak voltage is ±3 %.		P
	Impulse withstand voltage (Uimp)	4kV	P
	Auxiliary circuits not connected to main circuits are connected to earth.		P
	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:		P
	a) between all live parts of the main circuit connected together (including the 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	4,8kV	P
	b) between each live part of different potential of the main circuit and, the other live parts of different potential and exposed conductive parts connected together, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link;	4,8kV	P
	c) between each auxiliary circuit not normally connected to the main circuit and the – main circuit; – other circuits; – exposed-conductive-parts		N/A
	For an acceptable result there are no disruptive discharge during the impulse voltage tests.	No unintentional disruptive discharge during the tests	P
10.9.3.3	**Alternative power-frequency voltage test**		—
	The test voltage has a practically sinusoidal waveform at the rated frequency with a tolerance of ± 25 %.		N/A
	The overcurrent relay does not trip when the output current is less than 100 mA.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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 three cycles.		N/A
	It is applied:		N/A
	a) between all live parts of the main circuit connected together (including the 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 auxiliary circuit not normally connected to the main circuit and the – main circuit; – other circuits; – exposed conductive parts		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**		—
	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 sufficient to trip the overcurrent relay and it is greater than 100 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 three times for each polarity for a duration Of 10 ms		N/A
	It is applied:		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 the overcurrent relay does not operate and there is no disruptive discharge during the tests.		N/A
10.9.3.5	**Verification assessment**		—
	Clearances are verified by measurement, or verification of measurements on design drawings, employing the measurement methods stated in Annex F.		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 (Uimp).		N/A
10.9.4	**Testing of enclosures made of insulating material**		—
	For assemblies with enclosures made of insulating material, an additional dielectric test is carried out by applying an AC. 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.		N/A
	For this additional test, the test voltage is equal to 1,5 times the values indicated in Table 8.		N/A
10.9.5	**External door or cover mounted operating handles of insulating material**		—
	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.	1,5*1,89=2,84kV	P

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Clause	Requirement + Test	Result - Remark	Verdict
10.9.6	**Testing of conductors and hazardous live parts covered by insulating material to provide protection against electric shock**		—
	Conductors and hazardous live parts covered by insulating material in direct contact with the conductor so as to provide protection against electric shock, excluding those previously verified to their own product standard (e.g. cables), are subjected to an additional dielectric test.		N/A
	The test is carried out by applying an AC test voltage between a metal foil laid on the outside of the conductor insulation including openings and joints in the insulation, and the interconnected conductive parts within the insulation.		N/A
	The test voltage shall be equal to 1,5 times the values indicated in Table 8		N/A
10.10	**TEMPERATURE RISE**		—
10.10.1	**General**		—
	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.		P
	Verification is made by one or more of the following methods:		P
	a) testing (10.10.2);		P
	b) comparison with a reference design (10.10.3);		N/A
	c) assessment (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**		—
10.10.2.1	**General**		—
	a) 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
	b) The assembly is verified by one of the following methods:		P
	1) considering individual functional units, the main and distribution busbars and the assembly collectively according to 10.10.2.3.5;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	2) considering individual functional units separately and the complete assembly including the main and distribution busbars according to 10.10.2.3.6;		N/A
	3) 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
	c) 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**		—
	The test is made on one or more representative arrangements loaded with one or more representative load combinations chosen to determine with reasonable accuracy the maximum temperature rise under normal operating and installation conditions .		P
	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		P
	The original manufacturer takes into consideration in his selection for testing the configurations to be derived from the tested arrangements according to 10.10.3		P
10.10.2.2.2	**Busbars**		—
	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 geometric 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.		P
	For ratings of smaller busbar size variants or other materials see 10.10.3.3.		P
10.10.2.2.3	**Functional units**		—
	a) Selection of comparable functional unit groups		—

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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 60364-5-5. 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		—
	The maximum possible current rating for each variant of functional unit is established.		P
	For functional units containing only one device this is the rated current of the device.		P
	For functional units with several devices, it is that of the device with the lowest rated current.		P
	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.		P
	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.		P
	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.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
	If the functional unit can be arranged in different orientations (horizontal, vertical), then the most onerous arrangement is tested.		P
10.10.2.3	**Methods of test**		—
	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.		P
	Coils of relays, contactors, releases, etc., are supplied with rated operational voltage		P
	For assemblies with active cooling, the cooling equipment shall be operational, as in normal service.	Meet requirement	P
	The assembly is mounted as in normal use, with all covers including bottom cover plates, etc., in place.		P
	If the assembly includes fuses, these are fitted for the test with fuse-links as specified by the manufacturer.	Meet requirement	P
	Details of the fuse-links used for the test, i.e. the manufacturer's name and reference, the rated current, the power loss of the fuse-link, and the breaking capacity		P
	The type test with the specified fuse-links cover the use of any other fuse-link having a power loss, at the conventional thermal current of the combination unit, not exceeding the power loss of the fuse-link used for the test	Meet requirement	P
	The size and the disposition of external conductors used for the test are stated in the test report.	Meet requirement	P
	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.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
	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.		P
	The average value of the actual incoming test currents is between 100 % and 103 % of the intended value. Each phase is within ±5 % of the intended value		P
	Tests on an individual section of the assembly are acceptable		P
	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.		P
	When the performance of a single functional unit in one compartment is being tested as part of a complete assembly (or part of an assembly), the other 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**		—
	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.		P
	1) For values of rated current up to and including 400 A:		—
	a) the conductors are single-core, copper cables or insulated wires with cross-sectional areas as given in Table 11;		P
	b) as far as practicable, the conductors are in free air;		P
	c) the minimum length of each temporary connection from terminal to terminal is: – 1 m for cross-sections up to and including 35 mm2; – 2 m for cross-sections larger than 35 mm2.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	2) For values of rated current higher than 400 A but not exceeding 1600 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
	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 permissible 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 1600 A but not exceeding 7000 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 permissible 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 7 000 A:		—

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Clause	Requirement + Test	Result - Remark	Verdict
	The original manufacturer determines all relevant items of the test, such as type of supply, number of lines and frequency (where applicable), cross-sections of test conductors, etc. This information is part of the test report.	See attachment xxx	N/A
10.10.2.3.3	**Measurement of temperatures**		—
	Thermocouples or thermometers are used for temperature measurements.	Thermocouples	P
	For windings, the method of measuring the temperature by resistance variation is used.		N/A
	In cases where this is not practical, thermocouples are used to determine the temperature rise on the surface of the coil.		N/A
	The thermometers or thermo-couples is protected against air currents and heat radiation.	Meet requirement	P
	The temperature is measured at all points where a temperature-rise limit (see 9.2) must be observed.		P
	Particular attention is given to joints in conductors and terminals within the main circuits.		P
	For measurement of the temperature of air inside an assembly, several measuring devices are arranged in convenient places.		P
10.10.2.3.4	**Ambient air temperature**		—
	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.		P
	The thermometers or thermocouples are protected against air currents and heat radiation.		P
	The ambient temperature during the test is between +10 °C and +40 °C.	22,7	P
10.10.2.3.5	**Verification of the complete assembly**		—
	The main circuits of the assembly are loaded with their estimated group rated currents, I_{ng},		P
	If the group rated current, I_{ng}, of the incoming circuit or distribution busbar system is less than the sum of the group rated currents I_{ng} of all outgoing circuits, then the outgoing circuits are split into test sets corresponding to the group rated current of the incoming circuit or distribution busbar system.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The test sets are formed in a manner so that the highest possible temperature rise is obtained.		P
	Enough test sets are formed and tests undertaken so as to include all different variants of functional units in at least one test set.		P
	Where the fully loaded circuits do not distribute exactly the total incoming current, the remaining current is distributed via any other appropriate circuit.		P
	This test is repeated until all types of outgoing circuit have been verified at their group rated current.		P
	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**		—
	The group rated currents I_{ng}, according to 5.3.3 and the rated currents, I_{nc}, of the outgoing main circuits according to 5.3.2 and the rated diversity factor according to 5.3.3 are verified in two stages.		N/A
	The rated current, I_{nc}, of each critical variant of outgoing functional unit as defined in 10.10.2.2.3 b) is verified separately in accordance with 10.10.2.3.7 c).		N/A
	The assembly is verified by loading the incoming circuit and all outgoing functional units collectively to their estimated group rated currents, I_{ng} .		N/A
	If the group rated current, I_{ng}, of the incoming circuit or distribution busbar system is less than the sum of the currents I_{ng} of all outgoing circuits, then the outgoing circuits shall be split into test sets corresponding to the rated current of the incoming circuit or distribution busbar system.		N/A
	The test sets as defined by the original manufacturer are formed in a manner so that the highest possible temperature rise is obtained.		N/A
	Sufficient test sets are formed and tests undertaken so as to include all different variants of functional units in at least one test set.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	If I_{nc} and I_{ng} are verified, the RDF is calculated by dividing I_{ng} by I_{nc} for the individual circuits being considered.		N/A
10.10.2.3.7	**Verification considering functional units and the main and distribution busbars separately as well as the complete assembly**		—
	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
	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) Each distribution busbars is 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 rated current of the main busbar is higher than the test current, it is fed with additional current so that it carries its rated current to its junction with the distribution busbar.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	c) If the manufacturer declares I_{nc}, the relevant 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 intended to supply other circuits and they 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 the estimated rated current I_{nc} 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 and each outgoing functional unit are loaded to their group rated current I_{ng} where I_{ng} is equal to I_{nc} multiplied by RDF when I_{nc} is declared The test sets are formed in a manner so that the highest possible temperature rise is obtained. Enough test sets are formed and tests undertaken to include all different variants of functional units in at least one test set.		N/A
	If the main busbar and/or the distribution busbar (if any) are rated for a higher current, they shall be fed with additional currents so as to maintain the rating achieved in a) and b).		N/A
	If I_{nc} and I_{ng}, are verified the RDF is calculated by dividing I_{ng} by I_{nc} for the individual circuits being considered.		N/A
10.10.2.3.8	**Results to be obtained**		—
	At the end of the test, the temperature rise does not exceed the values specified in Table 6.	See table	P
	If tests according to 10.10.2.3.6 or 10.10.2.3.7 have been carried out to verify I_{nc} in addition to I_{ng}, for the outgoing circuits, then the rated diversity factor may be calculated		N/A
10.10.3.1	**General**		—
	Tests carried out at a particular frequency are applicable at the same current rating to lower frequencies including DC.		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
10.10.3.2	**ASSEMBLIES**		—
	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(s) 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 line conductors and arranged in the same manner.		N/A
10.10.3.3	**Busbars**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	Ratings established for aluminium busbars are valid for copper busbars with the same cross sectional dimensions and configuration.		N/A
	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
	If smaller cross-section than the one to be derived has been tested, which fulfils the conditions of 10.10.2.2.2, then the rating of the intermediate variants may be established by interpolation.		N/A
	Modification of the connection between main and distribution busbar is permissible if the modification is verified by a test in which the temperature-rise in the new arrangement is not higher than in a comparable test on the reference design.		N/A
10.10.3.4	**Functional units**		—
	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 I_{ng} ,and if determined, I_{nc}, 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, I_{nc} or I_{ng}, 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 I_{nc} or I_{ng},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
	Modification of the connection between functional unit and the main or distribution busbar is permissible if the modification is verified by a test in which the temperature-rise in the new arrangement is not higher than in a comparable test on the reference design		N/A
10.10.3.5	**Functional units – Device substitution**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	A device with a rated current I_n not exceeding 1600 A may be substituted with a similar device from another series from the same or a different device manufacturer to that used in the original verification, provided that the power loss and terminal temperature-rise of the substituting device is the same as or lower than the device used in the original verification, when both are tested in accordance with the devices' product standard		N/A
	Alternatively, and without a limit on current rating, when the original device and the substituting device are from the same device manufacturer, the device manufacturer can issue a declaration of temperature-rise performance. The declaration confirms that the substituting device can replace the original device with no further need for verification in respect of temperature-rise. The declaration includes statements indicating that the power loss for the substituting device is the same or lower than the original device.		N/A
	For both the above options the physical arrangement within the functional unit is maintained. The rating of a functional unit is not increased.		N/A
	The performance data on terminal temperatures and power loss may be obtained from the device manufacturer or from comparison tests undertaken by those responsible for the substitution		N/A
10.10.3.6	**Calculation of currents based on adjustment of ambient air temperature**		—
	Once a temperature-rise test has been carried out applying the temperature-rise limits for a daily average ambient air temperature of 35 °C, the rated currents confirmed by testing for a daily average ambient air temperature of 35 °C can be adjusted by calculation to determine rated current for daily average ambient air temperatures between 20 °C and 50 °C, assuming that the temperature-rise of each component or device is proportional to the power loss generated in this component.	See report	N/A
	I_2 cannot exceed the rated current of any device, (e.g. I_n for a circuit-breaker), within the circuit being considered, e.g. a circuit including a 1600 A circuit-breaker cannot be assigned a current rating of 1 750 A in an ambient air temperature of 20 °C.		N/A
10.10.4	**Verification assessment (does not apply for AEVCS)**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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
	Verification of the temperature rise may be made by calculation if all the following conditions and the additional conditions for the selected calculation method are fulfilled. are fulfilled:		—
	a) The rated frequency is up to and including 60 Hz.		N/A
	b) the power loss data for all built-in components is available from the component manufacturer;		N/A
	c) there is an approximately even distribution of power losses inside the enclosure;		N/A
	d) The mechanical parts and the installed equipment are so arranged that air circulation is not significantly impeded.		N/A
	e) The group rated current of the circuits, (I_{ng}), of the assembly as verified does not exceed 80 % of the rated conventional free air thermal current (I_{th}), or when I_{th} is not available, 80 % of the rated current (I_n) of the switching devices and electrical components included in the circuit. Circuit-protection devices are selected to ensure adequate protection to outgoing circuits, e.g. thermal motor protection devices at the calculated temperature in the assembly. The limitation to 80 % of the rated current I_{th} or I_n does not apply to electronic devices which incorporate means for forced ventilation when they are installed according to the device manufacturer's instructions		N/A
	f) All conductors directly connected to a device have a minimum cross-sectional area based on 125 % of the group rated current, Ing, of the associated circuit. Selection of cables is in accordance with IEC 60364-5-52.		N/A
	Or the device manufacturer has specified a conductor with a larger cross-sectional area.		N/A
	g) 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
	The effective power losses of all circuits including interconnecting conductors are calculated assuming the circuits are operating at their group rated current, Ing.		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, InA.		N/A
	The power losses of the conductors are determined by calculation (see Annex H and Annex K).		N/A
10.10.4.2	**Single compartment assembly with natural cooling and rated current (I_{nA}) not exceeding 630 A**		—
	Verification of the temperature-rise are made by calculation and all the general conditions listed in 10.10.4.1 are fulfilled	See report	—
10.10.4.2.2	**Determination of the power loss capability of an enclosure by test**		—
	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
	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**		—
	The assembly is verified if the enclosure is capable of dissipating power losses equal to or greater than those generated by the assembly at the maximum permissible air temperature-rise within the enclosure;.		N/A
	all conductors within the assembly have been selected to operate at the maximum permitted air temperature within the assembly.		N/A
10.10.4.3	**assembly with natural cooling and rated current (I_{nA}) not exceeding 1 600 A**		—
10.10.4.3.1	**Verification method**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	Verification of the temperature-rise may be made by calculation in accordance with the method of IEC TR 60890:2014 providing the additional requirements of 10.10.4.1 are fulfilled.		—
	The air temperature-rise within the assembly is then determined from the total power loss using the method of IEC TR 60890		—
	The air temperature within the assembly is calculated by adding this air temperature-rise and the daily average ambient air temperature of the assembly.		—
	If electronic devices with integral forced ventilation are incorporated, the enclosure is considered as having no natural ventilation, irrespective of whether or not openings exist in the enclosure.		—
10.11	**SHORT-CIRCUIT WITHSTAND STRENGTH**		—
	The short-circuit withstand strength declared is verified. Verification may be by the application of design rules, by calculation or by test.		N/A
10.11.3	**Verification by comparison with a reference design – Utilising a check list**		—
	Verification by the application of design rules is undertaken by comparison of the assembly to be verified with a reference design(s) using the check list provided in Table 13.	See attachment xxx	N/A
10.11.4	**Verification by comparison with a reference design – Utilising a check list**		—
	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 Annex M		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 stated in the verification documentation.	See attachment xxx	N/A
10.11.5	**Verification by test**		—
	The assembly or its parts as necessary to complete the test are mounted as in normal use.		N/A

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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**		—
	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
	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
	a) for assemblies suitable for use on three-phase four-wire systems 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
	b) 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 line conductor least likely to arc to earth.		N/A
	The connection mentioned in a) and b) 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**		—
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	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
	For an assembly including a pressure relief flap, if the pressure relief flap is optional, the capability of the assembly to withstand the generated pressure with and without the flap is verified		N/A
10.11.5.3.2	**Outgoing circuits**		—
	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 shall be closed and held closed in the manner normally used in service		N/A
	In the case of outgoing circuits which do not include an SCPD, the magnitude and duration shall be as specified for the main busbars by the original manufacturer		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Testing of outgoing circuits may also result in the operation of the incoming SCPD		N/A
10.11.5.3.3	**Incoming circuit and main busbars**		—
	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
	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**		—
	Where an assembly contains conductors including any distribution busbars 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 or mid-point conductor**		—
10.11.5.3.5.1	**Neutral conductor**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	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 line 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 line current during the three-line test.		N/A
	The test need not be executed if the test is intended to be made with a current of 60 % of the line current and if the neutral conductor is:		N/A
	– the same shape and cross- section as the line conductors		N/A
	– supported in an identical manner as the line 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 line conductors.		N/A
	The 4-pole busbar system is sectioned by a three pole device, the short-time withstand current test including the neutral is not executed because the test is intended to be made with a current of 60 % of the line current and		N/A
	a) the criteria listed above are met; and		N/A
	b) the neutral pole is part of a 4-pole busbar system that includes a 3-pole device, and		N/A
	c) the 3-pole device does not result in any changes to the support system to support the line and neutral conductors when the 3-pole device is not present.		N/A
10.11.5.3.5.2	**Mid-point conductor**		—
	The mid-point conductor is subjected to one test to prove its short-circuit withstand strength in relation to the line conductor of the circuit under test including any joints. Mid-point to line short-circuit connections shall be applied as specified in 10.11.5.3.3		N/A
	Unless otherwise agreed between the original manufacturer and the user, the value of the test current in the mid-point conductor is 100 % of the line to line test current		N/A

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	The test is not executed because the mid-point conductor is positioned between the line conductors and the following is fulfilled: – it is the same shape and cross-section as the line conductors; – it is supported in an identical manner as the line conductors and with support centres along the length of the conductor not greater than that of the line conductors; – it is spaced at an equal or greater distance than the distance between the line conductor(s).		N/A
	In the case of a short-time withstand current, the test is not executed because: a) the criteria listed above are met; and b) the mid-point pole is part of a 3-pole busbar system that includes a device; and c) the device does not result in any changes to the support system that would be necessary to support the line and mid-point conductors if the device were not present.		N/A
10.11.5.5	**Results to be obtained**		—
	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 are such that the mechanical and dielectric properties of the equipment satisfy the requirements of the relevant assembly standard.		N/A
	A busbar support or cable restraint is 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

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Clause	Requirement + Test	Result - Remark	Verdict
	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 equipment incorporated in the assembly is in a condition as prescribed in the relevant product standards and/or device manufacturer’s information, e.g. can be manually opened and closed.		N/A
	The fusible element (see 10.11.5.2),does not indicate a fault current.		N/A
	There is no arcing or flashover between poles of the protective device, or between poles and enclosure.		N/A
10.11.5.6	**Testing of the protective circuit**		—
	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 line conductor is used.		N/A
	Where the assembly is extendable, the protective circuit tested includes at least one joint.		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 line 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**		—
	The continuity and the short-circuit withstand strength of the protective circuit, whether it consists of a separate conductor or the frame or enclosure of the assembly , 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.	See table xx	N/A
	The earth continuity between the exposed-conductive-parts of a class I assembly and the protective circuit shall remain effective.		N/A
			N/A
10.12	**ELECTROMAGNETIC COMPATIBILITY (EMC)**		—
	For EMC tests, see J.10.12.		N/A
11	**Routine verification**		—
11.1	**General**		—
	Under the responsibility of the assembly manufacturer, all routine verification including testing, installation and commissioning carried out or supervised by a competent person.		N/A
	Verification shall comprise the following categories:		N/A
	a) Construction		N/A
	1) degree of protection against contact with hazardous live parts, ingress of solid foreign bodies and water of enclosures;		N/A

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	2) clearances and creepage distances;		N/A
	3) protection against electric shock and integrity of protective circuits;		N/A
	4) incorporation of built-in components;		N/A
	5) internal electrical circuits and connections;		N/A
	6) terminals for external conductors;		N/A
	7) mechanical operation.		N/A
	b) Performance		N/A
	1) dielectric properties;		N/A
	2) wiring, operational performance and function.		N/A
	c) Confirmation that documents that are intended to be supplied with the assembly are provided and include those required in 6.2.1.		N/A
11.2	**Degree of protection against contact with hazardous live parts, ingress of solid foreign bodies and water of enclosures**		—
	A visual inspection is necessary to confirm that the assembly meets the prescribed measures to achieve the designated degree of protection.		N/A
11.3	**Clearances and creepage distances**		—
	Where the clearances are:		N/A
	– less than the values given in Table 1, an impulse voltage withstand test in accordance with 10.9.3 shall be carried out;		N/A
	– not evident by visual inspection to be larger than the values given in Table 1		N/A
	– evidently larger by visual inspection than the values given in Table 1, verification may be carried out only by visual inspection.		N/A
11.4	**Protection against electric shock and integrity of protective circuits**		—
	The prescribed protective measures with regard to basic protection and fault protection subject to a visual inspection.		N/A
	The protective circuits checked by inspection to ascertain that the measures prescribed in the manufacturer's instructions are adhered to and verified		N/A
	Screwed and bolted connections checked for the correct tightness on a random basis.		N/A
11.5	**Incorporation of built-in components**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
	The installation and identification of built-in components in accordance with the assembly's manufacturing instructions.		N/A
11.6	**Internal electrical circuits and connections**		—
	Correct tightness on a random basis.		N/A
	Conductors checked in accordance with the assembly's manufacturing instructions.		N/A
11.7	**Terminals for external conductors**		—
	The number, type and identification of terminals checked in accordance with the assembly's manufacturing instructions.		N/A
11.8	**Mechanical operation**		N/A
	The effectiveness of mechanical actuating elements, interlocks and locks checked.		N/A
11.9	**Dielectric properties**		—
	This test need not be made on auxiliary circuits:		N/A
	– that are protected by a short-circuit protective device with a rating not exceeding 16 A;		N/A
	– if an electrical function test has been made previously at the rated operational voltage for which the auxiliary circuits are designed.		N/A
	As an alternative for assemblies with incoming protection rated up to 630 A and a rated voltage Un not exceeding 500 V.		N/A
	Between circuits and exposed-conductive-parts is at least 1 MΩ		N/A
11.10	**Wiring, operational performance and function**		—
	Depending on the complexity of the assembly, it may be necessary to inspect the wiring and to carry out an electrical function test.		N/A
	The test procedure and the number of tests depend on whether or not the assembly includes complicated interlocks, sequence control facilities, etc.		N/A
	In some cases, it may be necessary to make or repeat this test on site before putting the installation into operation.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	ANNEX J: ELECTROMAGNETIC COMPATIBILITY (EMC)		—
J.9.4	**Performance requirements**		—
J.9.4.1	The environmental condition A and/or B for which the assembly is suitable is stated by the assembly manufacturer.		N/A
J.9.4.2	**Requirement for testing**		—
	No EMC immunity or emission tests are required on final assemblies if the following conditions are fulfilled:		N/A
	a) The incorporated devices and components are in compliance with the requirements for EMC for the stated environment (see J.9.4.1) as required by the relevant product or generic EMC standard.		N/A
	b) The internal installation and wiring is carried out in accordance with the devices and Components Manufacturers‘ instructions (arrangement with regard to mutual influences, cable, screening, earthing etc.)		N/A
	In all other cases the EMC requirements are to be verified by tests as per J.10.12.		N/A
J.9.4.3	**Immunity**		—
J.9.4.3.1	**Assemblies not incorporating electronic circuits**		—
	Under normal service conditions, assemblies not incorporating electronic circuits are not sensitive to electromagnetic disturbances and therefore no immunity tests are required.		N/A
J.9.4.3.2	**Assemblies incorporating electronic circuits**		—
	Electronic equipment incorporated in assemblies comply with the immunity requirements of the relevant product or generic EMC standard and are suitable for the specified EMC environment stated by the assembly manufacturer.		N/A
	In all other cases the EMC requirements are to be verified by tests as per J.10.12.		N/A
	Equipment utilizing electronic circuits in which all components are passive (for example diodes, resistors, varistors, capacitors, surge suppressors, inductors) are not required to be tested.		N/A
	The assembly manufacturer obtains from the device and or component manufacturer the specific performance criteria of the product as given in the relevant assembly standard.		N/A
J.9.4.4	**Emission**		—

IEC 61439-7			
Clause	Requirement + Test	Result - Remark	Verdict
J.9.4.4.1	**Assemblies not incorporating electronic circuits**		—
	For assemblies not incorporating electronic circuits, electromagnetic disturbances can only be generated by equipment during occasional switching operations. The duration of the disturbances is of the order of milliseconds. The frequency, the level and the consequences of these emissions are considered as part of the normal electromagnetic environment of low voltage installations. Therefore, the requirements for electromagnetic emission are deemed to be satisfied, and no verification is necessary.		N/A
J.9.4.4.2	**Assemblies incorporating electronic circuits**		—
	Electronic equipment incorporated in the assembly comply with the emission requirements of the relevant product or generic EMC standard and are suitable for the specific EMC environment stated by the assembly manufacturer.		N/A
J.10.12	**Tests for EMC**		—
	The emission and immunity tests are carried out in accordance with the relevant EMC standard (see Tables J.1, J.2, J.3 and J.4); however, the assembly manufacturer specifies any additional measures necessary to verify the criteria of performance for the assemblies if necessary (e.g. application of dwell times).		N/A
J.10.12.2	**Immunity tests**		—
J.10.12.2.1	**Assemblies not incorporating electronic circuits**		—
	No tests are necessary.	—	—
J.10.12.2.2	**Assemblies incorporating electronic circuits**		—
	Tests are made according to the relevant environment: A or B		N/A
	The values used are given in Tables J.3 and/or J.4 except where a different test level is given in the relevant specific product standard.		N/A
	Electrostatic discharge immunity test IEC 61000-4-2	Performance criterion A/B/C	N/A
	Radiated radio-frequency electromagnetic field immunity test IEC 61000-4-3 at 80 MHz to 1 GHz and 1,4 GHz to 2 GHz	Performance criterion A/B/C	N/A
	Electrical fast transient/burst immunity test IEC 61000-4-4	Performance criterion A/B/C	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	1,2/50 µs and 8/20 µs surge immunity test IEC 61000-4-5	Performance criterion A/B/C	N/A
	Conducted radio-frequency immunity test IEC 61000-4-6 at 150 kHz to 80 MHz	Performance criterion A/B/C	N/A
	Immunity to power-frequency magnetic fields IEC 61000-4-8	Performance criterion A/B/C	N/A
	Immunity to voltage dips and interruptions IEC 61000-4-11	Performance criterion A/B/C	N/A
J.10.12.3	**Emission tests**		N/A
J.10.12.3.1	**Assemblies not incorporating electronic circuits**		N/A
	No tests are necessary		N/A
J.10.12.3.2	**Assemblies incorporating electronic circuits**		N/A
	Tests are made according to the relevant environment: A or B		N/A
	The test methods used; see J.9.4.4.2.		N/A
	If the assembly incorporates telecommunication ports, the emission requirements of CISPR 32, relevant to that port and to the selected environment, applies.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Heating Test		P
	Test voltage (V) ..... :	-	—
	Ambient (ºC) .....:	22,7	—

Thermocouple Locations	Max. temperature measured, (K)	Max. temperature limit, (K)
Incoming terminal of assembly-L1(a1)	27,7	70
Incoming terminal of assembly-L2(a1)	27,4	70
Incoming terminal of assembly-L3(a1)	27,5	70
Busbar fixed joint-L1(a2)	32,8	70
Busbar fixed joint-L2(a2)	33,7	70
Busbar fixed joint-L3(a2)	32,3	70
Incoming terminal of QF1-L1(a3)	36,2	70
Incoming terminal of QF1-L2(a3)	37,5	70
Incoming terminal of QF1-L3(a3)	37,8	70
Outgoing terminal of QF1-L1(a4)	34,2	70
Outgoing terminal of QF1-L2(a4)	35,1	70
Outgoing terminal of QF1-L3(a4)	37,3	70
Incoming terminal of KM1-L1(a5)	34,9	65
Incoming terminal of KM1-L2(a5)	35,6	65
Incoming terminal of KM1-L3(a5)	33,5	65
Outgoing terminal of KM1-L1(a6)	30,1	65
Outgoing terminal of KM1-L2(a6)	30,8	65
Outgoing terminal of KM1-L3(a6)	31,2	65
Incoming terminal of Rectifier Module-L1(a7)	30,4	70
Incoming terminal of Rectifier Module - L2(a7)	29,7	70
Incoming terminal of Rectifier Module - L3(a7)	29,1	70
Outgoing terminal of Rectifier Module - negative(a8)	28,0	70
Incoming terminal of K2-negative(a9)	32,7	70
Outgoing terminal of K2-negative(a10)	36,1	70
Incoming terminal of RS1-negative(a11)	35,2	70
Outgoing terminal of RS1-negative(a12)	34,5	70

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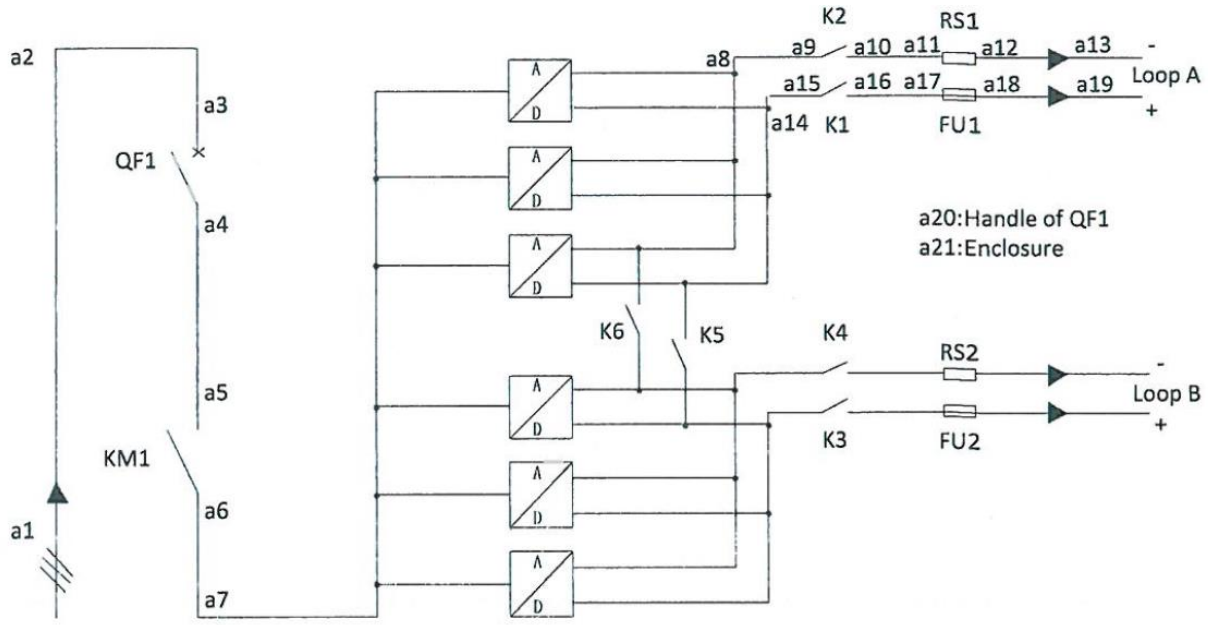
Clause	Requirement + Test	Result - Remark	Verdict

Outgoing terminal of Loop A-negative (a13)	32,2	70
Outgoing terminal of Rectifier Module - positive(a14)	28,1	70
Incoming terminal of K1- positive (a15)	33,7	70
Outgoing terminal of K1- positive (a16)	18,5	70
Incoming terminal of FU1- positive (a17)	35,6	70
Outgoing terminal of FU1- positive (a18)	32,8	70
Outgoing terminal of Loop A- positive (a19)	30,4	70
Handle of QF1(a20)	10,4	25
Enclosure	17,5	30

Supplementary information:

Test circuit for Temperature rise see below:



Test current: main basbur: 186A; Loop A: 200A

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Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Heating test, resistance method		N/A
	Test voltage (V) ..... :		—
	Ambient, t_1 (°C) ..... :		—
	Ambient, t_2 (°C) ..... :		—

Temperature rise of winding	R_1 (Ω)	R_2 (Ω)	ΔT (K)	Max. dT (K)	Insulation class
Supplementary information:					

	TABLE: Dielectric Strength		P
Test voltage applied between:		**Test potential applied (V)**	**Breakdown / flashover (Yes/No)**
between all live parts of the main circuit connected together (including the 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		1890	No
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;		1890	No
Supplementary information:			

	TABLE: Electrical Data (in normal conditions)					N/A
fuse #	**I rated (A)**	**U (V)**	**P (W)**	**I (mA)**	**I fuse (mA)**	**condition/status**
Supplementary information:						

	TABLE: insulation resistance measurements		N/A
Insulation resistance R between:		**R (MΩ)**	**Required R (MΩ)**
Between mains poles (primary fuse disconnected)			

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Clause	Requirement + Test	Result - Remark	Verdict

Between parts separated by basic or supplementary insulation		
Between parts separated by double or reinforced insulation		
Supplementary information:		

	TABLE: Impact Resistance		N/A
Impacts per surface	**Surface tested**	**Impact energy (Nm)**	**Comments**
Supplementary information:			

	TABLE: Clearance And Creepage Distance Measurements					P
clearance cl and creepage distance dcr at/of:	**Up (V)**	**U r.m.s. (V)**	**Required cl (mm)**	**cl (mm)**	**required dcr (mm)**	**dcr (mm)**
Between phases	4000	400	3	14,0	6,3	30,7
Between live part and exposed conductive parts	4000	400	3	20,7	6,3	25,4
Supplementary information:						

	TABLE: Distance Through Insulation Measurements			N/A
Distance through insulation di at/of:	**U r.m.s. (V)**	**Test voltage (V)**	**Required di (mm)**	**di (mm)**
Supplementary information:				

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Clause	Requirement + Test	Result - Remark	Verdict

	TABLE: Ball Pressure Test of Thermoplastics		N/A
Allowed impression diameter (mm) ..... :			—
Object/ Part No./ Material	Manufacturer/ trademark	Test temperature (°C)	Impression diameter (mm)
Supplementary information:			

	TABLE: Needle- flame test (NFT)				N/A
Object/ Part No./ Material	Manufacturer/ trademark	Duration of application of test flame (ta); (s)	Ignition of specified layer Yes/No	Duration of burning (tb) (s)	Verdict
Supplementary information: **NFT not relevant (or applicable) for Parts of material classified as V-0 or V-1** **NFT not relevant (or applicable) for Base material of PCBs classified as V-0 or if relevant VTM-0**					

	TABLE: Resistance to heat and fire - Glow wire tests							P
Object/ Part No./ Material	**Manufacturer / trademark**	**Glow wire test (GWT); (°C)**						**Verdict**
		550	**650**		**750**		**~~850~~**	
			te	**ti**	**te**	**ti**		
Busbar clamp							960	P
Insulator							960	P
Insulation baffle							650	P
Object/ Part No./ Material	**Manufacturer / trademark**	**Glow-wire flammability index (GWFI), °C**				**GW ignition temp. (GWIT), °C**		**Verdict**
		550	**650**	**750**	**850**	**675**	**775**	

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Clause	Requirement + Test	Result - Remark	Verdict

								-
The test specimen passed the glow wire test (GWT) with no ignition [($t_e - t_i$) ≤ 2s] (Yes/No):								-
If no, then surrounding parts passed the needle-flame test of annex E (Yes/No)..... :								-
The test specimen passed the test by virtue of most of the flaming material being withdrawn with the glow-wire (Yes/No)? ..... :								-
Ignition of the specified layer placed underneath the test specimen (Yes/No)..... :								-
Supplementary information: 550 °C GWT not relevant (or applicable) to parts of material classified at least HB40 or if relevant HBF The GWIT pre-selection option, the 850 °C GWFI pre-selection option, and the 850 °C GWT are not relevant (or applicable) for attended appliances.								

	TABLE: Threaded Part Torque Test			N/A
Threaded part identification	**Diameter of thread (mm)**	**Column number (I, II, or III)**	**Applied torque (Nm)**	
Supplementary information:				

	TABLE: Over-voltage and Under-voltage Test					N/A
Test	**Operating condition**	**Rated voltage (V)**	**Test voltage (V)**	**Temperature (ºC)**	**Comments**	
Supplementary information:						

	TABLE: Critical components information				P
Object / part No.	**Manufacturer/ trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity[1)]**
- Description:					
AC circuit breaker (QF1)	ABB	XT4N 250 TMA 250 1250-2500 4P	690VAC，250A，4P	EN 60947-2	CE

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Clause	Requirement + Test	Result - Remark	Verdict

AC Contactor (KM1)	ABB	AX260-30-11-80	690VAC,260A,3P	EN 60947-4-1	CE
DC Contactor （K2）	YM	EVR250	250A,1000VDC, Coil Rating：12V	EN 60947-4-1	CE
DC Fuse (FU1)	ADLER	EFX3350A43	DC 1000V, 350A	EN 60269-4	CE

Supplementary information:

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

List of test equipment used:

A completed list of used test equipment shall be provided in the Test Reports when a Customer's Testing Facility according to CTF stage 1 or CTF stage 2 procedure has been used.
Note: This page may be removed when CTF stage 1 or CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date

Statement of Measurement Uncertainty

The Test Report shall include a statement concerning the uncertainty of the measurement systems used for the tests conducted when it is required by the standard, client or other authorities.
In such cases, the table below is to be used for reporting U of M.

This page may be removed from the final Test Report when not required. See also clause 4.8 in OD 2020 for more details.

Clause #	Parameter/ Measurement / test method	Requirement % or k	Calculated U of M*

*Note: Calculations leading to the reported value are on file with the NCB

Attachment 1

Photograph documentation with sample