



WHITE
PAPER



CONSTRUCTION AND
CERTIFICATION OF ASSEMBLIES
IEC 61439-2

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LEGRAND SUPPORTS YOU ON ALL YOUR PROJECTS

This white paper is designed to assist assembly builders by outlining the essential rules for constructing low-voltage (BT) assemblies in compliance with the IEC 61439-2 standard, updated in July 2020.

The document serves as a reminder of the tests, responsibilities, and roles of both the original manufacturer and the assembly builder.

LEGAL INFORMATION

Presentation pictures do not always include Personal Protective Equipment (PPE), but this is a legal and regulatory obligation that must be scrupulously respected.

In accordance with its continuous improvement policy, Legrand reserves the right to change the specifications and illustrations without notice. All illustrations, descriptions and technical information included in this document are provided as indications and cannot be held against Legrand.



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Legrand Supports You in Your Project

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ROLE AND RESPONSIBILITY OF EACH PARTY

Since July 2020, Edition 3 of the IEC 61439-1 and IEC 61439-2 standards has replaced the previous Edition 2 from August 2011. Legrand is making every effort to promote compliance of power switchgear assemblies with these new standards.

The IEC 61439-1 standard defines the general rules relating to assemblies for low-voltage installations. It provides definitions, specifies operating conditions, construction requirements, technical characteristics, and verification requirements.

The IEC 61439-2 standard, on the other hand, is a product standard that defines the specific requirements for power switchgear assemblies (PSA).

The new IEC 61439 series clearly reiterates the responsibilities of the various stakeholders and continues to distinguish the role of the original manufacturer (Legrand or panel builder) from that of the assembly manufacturer (panel builder).



IEC 61439-2 Standard - Edition 3

In 4 key points, here are the major changes to consider for your future power switchgear assembly (PSA) projects:

- **Group Rated Current of a Main Circuit (Ing):** A new characteristic applied to each main circuit. It ensures that a panel with a specific configuration and operating profile will meet the end user's expected usage. Specifiers should strive to provide the operating current for each main circuit. The original manufacturer must be able to verify that the PSA can supply the required currents to the loads without excessive heating.

- **Temperature Rise:** New provisions allow, under certain conditions, verification by calculation for naturally ventilated PSAs, including circuits above 1600A, or PSAs equipped with forced ventilation up to 1600A. This makes it possible to reduce the number of actual laboratory tests.

- **Internal Arc:** The new standard acknowledges the possibility of an internal arc fault occurring in a PSA, even though the risk remains very low if design, construction, and inspection conditions are met. However, to enhance safety and operational performance, some users require additional technical solutions to cover these risks.

- **Definition Updates:**
 - clarification between a Class I or Class II PSA with appropriate protective measures.
 - distinction between the "macro" environment outside the assembly, for which the assembly must be suitable, and the "micro" environment inside the assembly, for which it must be perfectly adapted to the equipment housed within the PSA⁽¹⁾ enclosure.

(1) PSA : Power Switchgear Assembly

A complete system of electrical and mechanical components (enclosures, busbars, functional units, etc.) as defined by the original manufacturer and intended to be assembled according to their instructions.

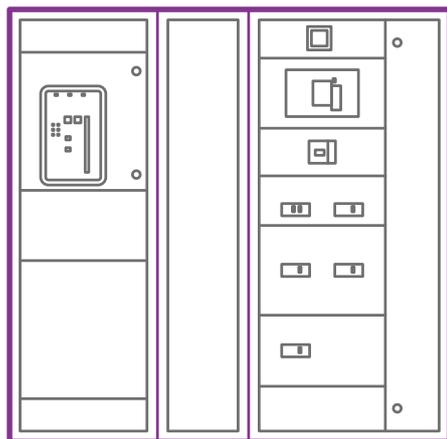


ROLE AND RESPONSIBILITY OF EACH PARTY

Original Manufacturer

Entity responsible for designing a PSA (Power Switchgear Assembly) in compliance with the construction and performance requirements of IEC 61439-2. It is accountable for the PSA design, which must be accompanied by a certificate or a declaration of conformity covering 11 points. The designation of the entity holding this role may vary depending on the project. All products making up the assembly must have certificates of conformity and be accompanied by technical documentation.

ORIGINAL MANUFACTURER



Standard configuration compliant with the construction and performance requirements of IEC 61439-2

11 design verifications



Certificate of conformity or declaration of conformity

Legrand undertakes to carry out the design verifications required by IEC 61439-2 on standard configurations, as the original manufacturer, and to issue the corresponding certificates.



The verifications performed by Legrand during test campaigns correspond to critical configurations to assess product reliability and system robustness.

They do not correspond to an actual assembly configuration, but these verifications serve as a basis for comparison or evaluation (see p.10).



Assembly Manufacturer

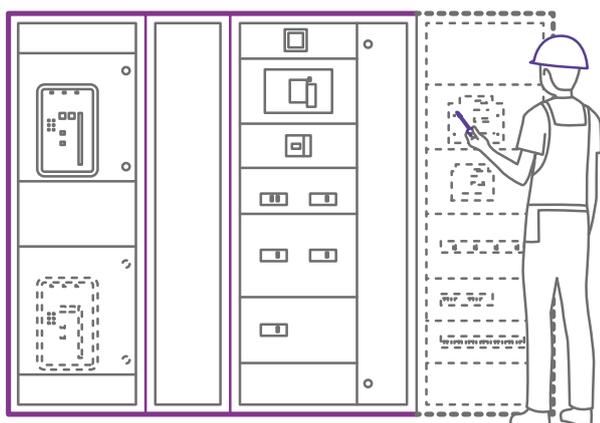
Entity responsible for assembling, wiring, and taking responsibility for the finished PSA.

The assembly manufacturer builds the electrical cabinet in compliance with the assembly rules provided by Legrand and/or the original manufacturer's instructions.

They perform 9 routine individual verifications on each manufactured assembly, which allow them to issue the declaration of conformity for their assembly.

Compliance with the IEC 61439-2 standard also allows the CE marking to be applied if required.

ASSEMBLY MANUFACTURER



Modifications compared to the configuration validated by the original manufacturer



The certification or declaration of conformity becomes the responsibility of the assembly manufacturer

The assembly manufacturer becomes the original manufacturer



The assembly manufacturer becomes the original manufacturer as soon as any design element of the PSA differs from the configurations previously verified by Legrand.



THE 11 VERIFICATIONS TO BE CARRIED OUT BY THE ORIGINAL MANUFACTURER

The IEC 61439-2 standard requires the verification of 11 points for the certification of PSA.

These verifications must be carried out on the finished assembly. They do not replace product compliance with their own standards.



Depending on the verification to be carried out, 3 different methods are possible:

- By **testing** performed on a sample assembly or on parts of an assembly.
- By structural **comparison** of a proposed assembly design, or parts of an assembly, with a reference design tested and proven.
- By **evaluation** of compliance with design rules applied to a PSA, including safety margins.

 If all the requirements and instructions provided by Legrand are fully respected, the assembly manufacturer does not need to repeat these verifications on the finished assembly.

 When the assembly manufacturer incorporates its own devices not included in the original manufacturer's certification, it is considered responsible as the designer regarding these provisions and must provide the corresponding evidence.





Legrand provides certificates of conformity issued on a PSA guaranteeing its design in accordance with the requirements of the IEC 61439-2 standard. These verifications are carried out by independent organizations.

Certificate of Conformity

LOVAG-Certificate No.: IT 18.138
Page 1 of 2

Apparatus: Low-voltage assembly
415 V (U_n) – 690 V (U) – 5 kV (U_{imp}) – 50/60 Hz (f) – 630 A (I_{nom}) – 36 kA (I_{sc})
– 36 kA (I_{sc}) x 0,5 s (t) – IP40 – IK08

Designation Type XL^S S 630 Arrangement 147

Manufacturer Legrand SA
128, Avenue du Marechal du Lattre de Tassigny
87045 Limoges Cedex – France

Applicant: Legrand SA
128, Avenue du Marechal du Lattre de Tassigny
87045 Limoges Cedex – France

Verified by: ACAE Laboratory :
IB01 Varese (Italy)

The apparatus, constructed in accordance with the description mentioned in the Report listed in this Certificate has been subjected to the series of proving verifications in accordance with IEC 61439-2 Ed.2.0 (2011-08) and EN 61439-2 (2011-10):

- 10.2.2 Resistance to corrosion
- 10.2.5 Lifting
- 10.2.6 Mechanical impact
- 10.4 Clearance and creepage distances
- 10.5 Protection against electrical shock and integrity of the protective circuit
- 10.6 Incorporation of switching devices and components
- 10.7 Internal electrical circuits and connections
- 10.8 Terminals for external conductors
- 10.9 Dielectric properties
- 10.10.2.3.5 Temperature rise
- 10.11 Short circuit withstand strength
- 10.13 Mechanical operation

The results are shown in the Report in accordance to LOVAG. The values obtained and the general performance are considered to comply with the above Standard(s) and to justify the characteristics assigned by the manufacturer as stated at pages no. 2

Responsible Certification Body: ACAE
Via Tito Livio, 5 – 24123 – BERGAMO (Italy)

PSD n°0708
Signatory of EA, IAF and ILAC
Mutual Recognition Agreements

Authorized Signature: Virginia Scarpini
Date: 2018.12.17

MCO 007 pag 1 Revision 07

Certificate of Conformity

LOVAG-Certificate No.: IT 18.138
Page 2 of 2

Circuit	Incoming vert. busbar	Horizontal busbar		Functional Units	
		CC5	CC6	CC5	D1
Rated operational voltage (U _n) V	415	415	415	415	415
Rated insulation voltage (U _i) V	690	690	690	690	690
Loading condition 1	Rated current (I _{nc}) A	630	176	280	176
	Rated diversity factor	1	1	1	1
Loading condition 2	Rated current (I _{nc}) A	630	515	0	515
	Rated diversity factor	1	1	1	1
Rated short-time withstand current (I _{sc}) kA – (t) s	36 – 0,5	36 – 0,5	-	-	-
Rated peak withstand current (I _{pk}) kA	75,6	75,6	-	-	-
Rated conditional short-circuit current (I _{sc}) kA	36	36	36	36	36

Circuit	Functional Units					
	D2	D3	CC3	CC4	CC1	CC2
Rated operational voltage (U _n) V	415	415	415	415	415	415
Rated insulation voltage (U _i) V	690	690	690	690	690	690
Loading condition 1	Rated current (I _{nc}) A	0	0	88	88	0
	Rated diversity factor	-	-	1	1	-
Loading condition 2	Rated current (I _{nc}) A	117	176	0	112	55
	Rated diversity factor	1	1	-	1	1
Rated short-time withstand current (I _{sc}) kA – (t) s	-	-	-	-	-	-
Rated peak withstand current (I _{pk}) kA	-	-	-	-	-	-
Rated conditional short-circuit current (I _{sc}) kA	36	36	36	36	36	36

This document includes : Assessment report No. 1555
Issue date: 2018.11.07
Test report No. 1160
Issue date: 2017.09.20
Test report No. 1255
Issue date: 2018.01.05
Test report No. 1484
Issue date: 2018.07.25
Test report No. 1528
Issue date: 2018.10.16

Responsible Certification Body: ACAE
Via Tito Livio, 5 – 24123 – BERGAMO (Italy)

PSD n°0708
Signatory of EA, IAF and ILAC
Mutual Recognition Agreements

Authorized Signature: Virginia Scarpini
Date: 2018.12.17

MCO 007 pag 2 Revision 08



THE 11 DESIGN VERIFICATIONS ACCORDING TO IEC 61439-2:2020

1 Strength of materials and parts

The mechanical, electrical, and thermal robustness of construction materials and assembly parts must be proven by verifying construction and performance characteristics.

Tests are carried out to check resistance to:

- corrosion;
- heat;
- ultraviolet (UV) exposure;
- lifting;
- mechanical impacts (IK);
- marking durability;
- mechanical movements (200 cycles).

2 Verification of degree of protection (IP)

The IP rating defines the level of protection of an enclosure against the ingress of solid objects (first digit) and liquids (second digit).

The additional letter indicates protection against access to hazardous parts only.

3 Clearances and creepage distances

The measurement methods for creepage distances and clearances are precisely specified in Annex F of IEC 61439-2:2020. Distances are measured between live parts of different potentials, as well as between live parts and exposed conductive parts.

4 Effectiveness of the protective circuit

The continuity of the protective circuit is a key safety element. It is verified: according to IEC 61439-2 under a test current of 25 A between the protective conductor terminal and all exposed conductive parts; and by an additional test under a fault current that may occur following an internal short circuit.

5 Incorporation of devices and components

These are the rules concerning the installation of devices compliant with their own product standards within the assembly, whether fixed or removable parts, as well as compliance with wiring according to customer requirements. This also includes accessibility to adjustment and resetting devices, and all types of indicators (lights, dials, etc.).

6 Internal electrical circuits and connections

This test consists of verifying compliance with design requirements for power and control circuits. It includes correct sizing of the busbar system and cables, grounding of control circuits, color coding of different circuits, etc.



7 Terminals for external conductors

This rule requires that the indication of terminal capacity, as well as the possibility of accommodating aluminum or copper, be specified to the end user.

It also includes verification of all types of terminals that can be used for cable entry or exit (Neutral, PEN, PE symbol, etc.).

8 Dielectric properties

Dielectric tests check the insulation performance of the assembly for maximum operating voltages.

They are carried out at the industrial frequency of 50 Hz and using voltage waves simulating a lightning impulse.

9 Temperature rise limits

The temperature rise verification of assemblies ensures proper system operation under maximum operating conditions (current, number of devices, enclosure volume).

It helps define the thermal balance elements for a large number of components in the electrical panel, with an ambient temperature between 10°C and 40°C.

Temperature rise limits are required by the standard for different sub-parts of the assembly.

10 Short-circuit withstand strength

Tests performed guarantee, with respect to thermal and electrodynamic stresses, the strength of busbars and their supports, switching devices (Vistop/DPX-IS), protection devices (DMX³/DPX³/DX³), and enclosures.

11 Electromagnetic compatibility (EMC)

This verification ensures that the integrated devices comply with the requirements of their own standards and that the manufacturers' installation recommendations are followed.



TABLE OF THE 11 DESIGN VERIFICATIONS

Below is a summary table of the 11 design verifications

- carried out by Legrand as the original manufacturer;

or

- to be carried out by the panel builder (by test, comparison, or evaluation according to the table below), if the design of the assembly produced is not identical in every respect to that of Legrand.

DESIGN VERIFICATIONS						
No. Characteristics to Verify	Article or Paragraphs	Standardized verification methods			Certificate / Declaration of Conformity	
		Tests	Comparison	Evaluation		
1	Strength of materials and parts:	10.2				YES
	- Corrosion resistance	10.2.2	YES	YES	NO	
	- Properties of insulating materials:	10.2.3				
	Thermal stability	10.2.3.1	YES	YES	NO	
	Resistance of insulating materials to abnormal heat and fire caused by internal electrical effects	10.2.3.2	YES	YES	YES	
	- Resistance to ultraviolet (UV) radiation	10.2.4	YES	YES	YES	
	- Lifting	10.2.5	YES	YES	NO	
	- Mechanical impact (IK)	10.2.6	YES	YES	NO	
	- Marking	10.2.7	YES	YES	NO	
	- Mechanical operations	10.2.8	YES	YES	NO	
2	Degree of protection provided by enclosures (IP)	10.3	YES	NO	YES	YES
3	Clearance and creepage distances	10.4	YES	NO	NO	YES
4	Protection against electric shock and integrity of protective circuits:	10.5				YES
	- Actual continuity between exposed conductive parts and protective circuit in Class I assemblies	10.5.2	YES	NO	NO	
	- Short-circuit withstand capability of protective circuits	10.5.3	YES	YES	NO	





DESIGN VERIFICATIONS (continued)

No. Characteristics to Verify	Article or Paragraphs	Standardized verification methods			Certificate / Declaration of Conformity	
		Test	Comparison	Evaluation		
5	Integration of connection devices and components	10.6	NO	NO	YES	YES
6	Internal electrical circuits and connections	10.7	NO	NO	YES	YES
7	Terminals for external conductors	10.8	NO	NO	YES	YES
8	Dielectric properties:	10.9				YES
	- Power frequency withstand voltage	10.9.2	YES	NO	NO	
	- Impulse withstand voltage	10.9.3	YES	NO	YES	
	- Enclosures made of insulating material	10.9.4	YES	NO	NO	
	- External controls made of insulating material	10.9.5	YES	NO	NO	
	- Conductors covered with insulating material to provide protection against electric shock	10.9.6	YES	NO	NO	
9	Temperature rise limits	10.10	YES	YES	YES	YES
10	Short-circuit withstand capability	10.11	YES	YES	NO	YES
11	Electromagnetic compatibility (EMC)	10.12	YES	NO	YES	YES



LEGRAND SOLUTIONS

Legrand supports you throughout your project in compliance with IEC 61439-2, from the project study to the realization of your PSA, so that the documents can be delivered to the project management and installers.

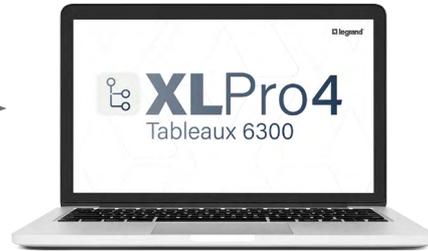
DESIGN AND EXECUTION ENGINEERING OFFICES

Drafting of the specifications and study of the electrical architecture of the project.

PANEL BUILDER

Realization of the PSA.

PROJECT STUDY



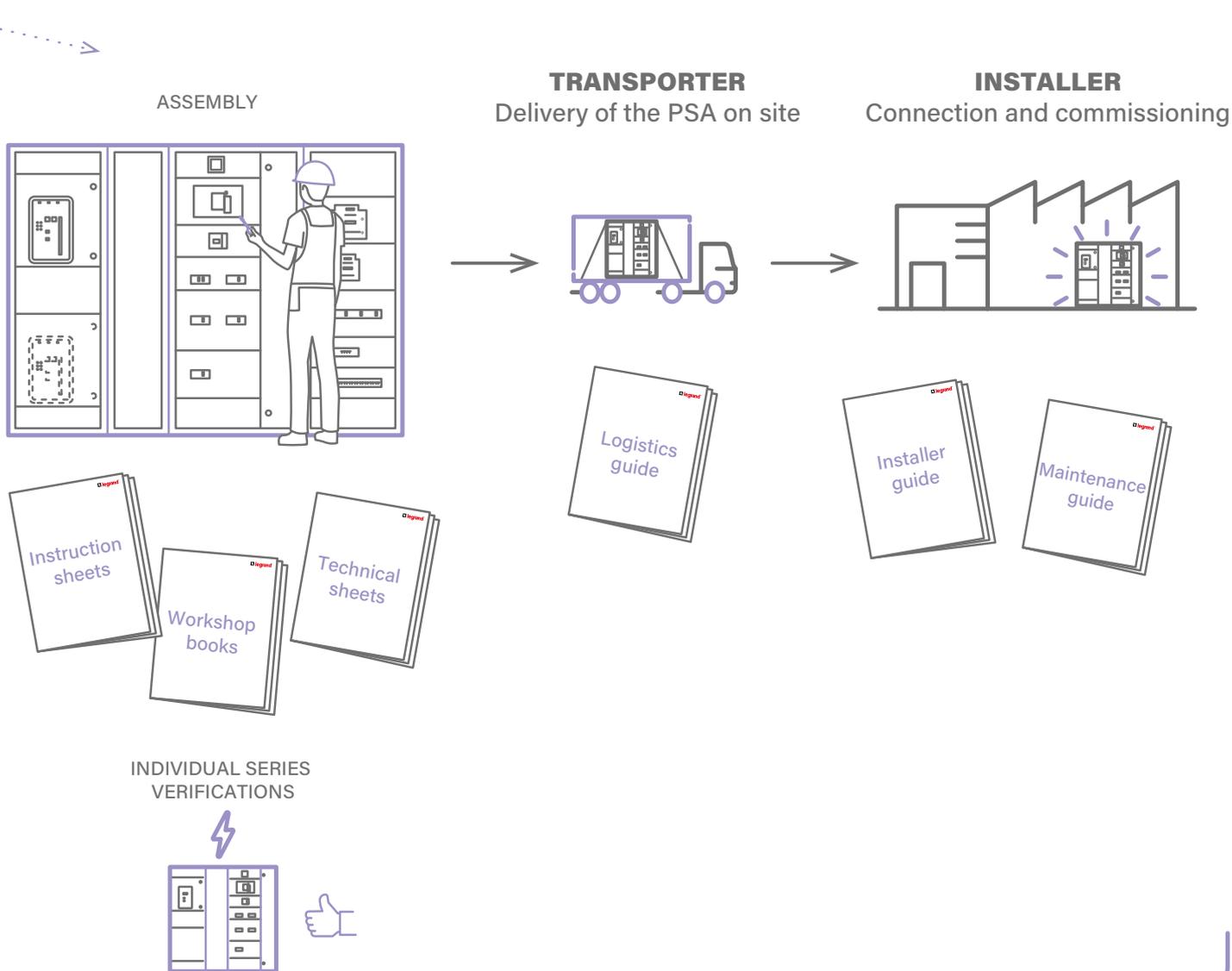
The XLPro4 Panels software allows you to:

- create adapted electrical diagrams
- design the PSA layout
- perform thermal studies

The XLPro4 Calcul 6300 software allows you to produce calculation notes.



Different tools help you save time and provide the essential technical elements to meet the requirements of the standard: XLPro4 Calcul 6300 and XLPro4 Panels 6300 software, instruction sheets, technical sheets, workshop books, technical guides, etc.



CONTACT YOUR LEGRAND SALES REPRESENTATIVE

INDIVIDUAL SERIES VERIFICATIONS

The IEC 61439-2 standard requires that an individual series verification be carried out on each fully assembled equipment assembly (including wiring) before it leaves its place of production or the dispatch area at the PSA manufacturer. These verifications can be performed during the construction process or as a final operation by the equipment assembly manufacturer (PSA) or panel builder.

This essential step aims to detect any potential defects in components or assembly and to confirm the proper functioning of the PSA in accordance with safety rules and customer expectations.

The individual series verification of PSA is described in clause 11 of the IEC 61439-2 standard. These verifications are carried out using simple tests and inspections, including comparisons with the original manufacturer's instructions.

The assembly manufacturer must provide a declaration or certificate of conformity; templates are available on pages 26 and 27.

 Individual series verifications are not required for equipment or devices that comply with their own standard, as well as for specific components incorporated and installed in the PSA in accordance with the manufacturer's assembly instructions. The use of cabinets, devices, distribution systems, or any other solution marketed by Legrand meets this requirement.

▪ The 9 Individual Series Verifications

To carry out all individual verification operations, the PSA manufacturer has two methods available:

Visual inspection or test

Verification	Clause of the standard	Objective	Methods
Degree of protection provided by enclosures	11.2	Verify the degree of protection required by the customer or the standard	Visual inspection
Clearances and creepage distances	11.3	Verify the insulation performance of a device to ensure the protection of persons under normal or abnormal operation	Visual inspection, dimensional measurement, or impulse withstand voltage test in case of persistent doubt
Protection against electric shock and integrity of protective circuits	11.4	Verify the main protective measures and in case of fault	Visual inspection, if possible, or continuity test with a 10 A current (see paragraph 10.5.2 of the standard).
Integration of connection devices and components	11.5	Verify the installation of devices in accordance with the manufacturer's instructions	Visual inspection
Internal electrical circuits and connections	11.6	The tightening of connections, especially screwed and bolted ones, must be verified by random sampling. Conductors must be verified in accordance with the assembly manufacturer's instructions	Visual inspection and random testing
Terminals for external conductors	11.7	Verify the number, type, and identification of terminals. They must comply with the assembly manufacturer's instructions	Visual inspection
Mechanical operation	11.8	Verify the proper operation of moving parts and mechanisms	Visual inspection and operational tests
Dielectric properties	11.9	Verify the resistance to breakdown voltages	Test
Wiring, electrical operation, and function	11.10	Verify the provided instructions, proper wiring execution, and basic operations...	Visual inspection with simple functional tests if necessary



Article 11.2 - Degree of Protection Provided by Enclosures

The degree of protection of an assembly defines its ability to protect persons from direct contact with live parts and to prevent the ingress of solid foreign objects or liquids. It is specified by the IP code (Ingress Protection), with tests described in standard IEC 60529 (see below). The IP code required for an enclosed assembly depends on its installation conditions and the external influences it is subjected to. In all cases, it must be at least IP 2X. The degree of protection for an open assembly must be at least IP XXB.



WHAT THE ASSEMBLY MANUFACTURER MUST DO

The assembly manufacturer must ensure, through visual inspection once the assembly of the various components is completed, that the declared degree of protection of the enclosure and its components is maintained.

For example, if control and signaling auxiliaries are installed on a door or panel, their own IP rating and installation must comply with the declared IP degree.

In this case, no additional testing is required.

Compliance with the assembly instructions provided by Legrand ensures the declared IP performance of XL³ HP enclosures.

DEGREE OF PROTECTION OF LEGRAND ENCLOSURES

Type of Enclosure	Without Door	With Door
XL ³ HP 160	IP 30	IP 40 ⁽¹⁾
XL ³ HP 630	IP 30	IP 40 ⁽¹⁾
XL ³ HP 630 IP 55	-	IP 55
XL ³ HP 6300	IP 30	IP 55 ⁽²⁾

⁽¹⁾: IP43 with seals

⁽²⁾: with IP55 panels



INDIVIDUAL SERIES VERIFICATIONS

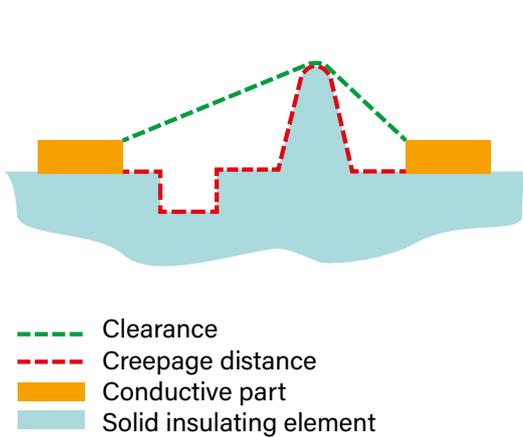
Article 11.3 - Clearances and Creepage Distances

Clearances represent the shortest path through air between two conductive parts at different potentials. In the event of disruptive breakdown of air, the electric arc would follow this path.

The minimum clearance distances are determined based on the impulse withstand voltage (U_{imp}) of the assembly.

Creepage distances represent the shortest path along the surface of insulating materials.

The minimum creepage distances are determined based on the rated insulation voltage (U_i) declared for the assembly and the pollution degree of the installation environment in which the PSA must operate.



i

Reminder on Common Pollution Degrees:

- **Pollution Degree 2** generally intended for residential environments.

Presence of non-conductive pollution only. Occasionally, slight condensation (such as dew) may cause temporary electrical conduction.

- **Pollution Degree 3** generally intended for industrial environments.

Presence of conductive pollution or dry, non-conductive pollution that may become conductive due to condensation.

Principle of Microenvironment and Macroenvironment:

The IEC 61439-2 standard allows devices designed for Pollution Degree 2 to be installed in a microenvironment protected by an enclosure resistant to a more severe external environment, called the macroenvironment (for example: Pollution Degree 3).

WHAT THE ASSEMBLY MANUFACTURER MUST DO

Compliance with clearances and creepage distances largely depends on following the prescribed requirements and the care taken during the assembly of components. It is therefore the responsibility of the assembly manufacturer to verify the finished assembly through visual inspection or physical measurement if visual inspection is insufficient.

Distances are measured between live parts of different polarities, as well as between live parts and exposed conductive parts. The measurement methods are described in Annex F of the IEC 61439-1 standard.

Experience shows that the greatest risk lies in assembly and wiring. Connectors, bolted joints, splices, and unsuitable metal supports can reduce clearances. Particular attention must therefore be paid to:

- distances between device connections (lugs, terminals, etc.) and nearby exposed conductive parts (chassis, mounting plate, etc.);
- distances between connections;
- bolted connections and connections on busbars (distances from other busbars and from exposed conductive parts).

If necessary, partitions or insulating barriers may be installed to increase air clearances.

If the clearances are less than the values in the adjacent table, an impulse withstand voltage test must be performed.



MINIMUM AIR CLEARANCE DISTANCES ACCORDING TO IEC 61439-1	
Rated impulse withstand voltage U_{imp} (kV)	Minimum air clearance distance ⁽¹⁾ (mm)
≤ 2,5	1,5
4	3
6	5,5
8	8
12	14

⁽¹⁾ Based on non-homogeneous field conditions and pollution degree 3



HORIZONTAL AND VERTICAL DISTRIBUTION HX³ AND VX³
 The installation and connection of these devices and equipment ensure compliance with the minimum clearance distances for their insulation voltages, when installed under the prescribed conditions.



The correspondence between the rated voltage of the power supply network and the equipment's rated impulse withstand voltage (U_{imp}) is given in Table G1 of IEC 61439-1.

Rated insulation voltage U_i (V) ⁽¹⁾ ($U_i \geq U_e$)	Pollution degree							
	1	2			3			
	All material groups ⁽²⁾	Material group ⁽²⁾			Material group ⁽²⁾			
		I	II	IIIa IIIb	I	II	IIIa	IIIb
250	1,5	1,5	1,8	2,5	3,2	3,6	4	4
320	1,5	1,6	2,2	3,2	4	4,5	5	5
400	1,5	2	2,8	4	5	5,6	6,3	6,3
500	1,5	2,5	3,6	5	6,3	7,1	8	8
630	1,8	3,2	4,5	6,3	8	9	10	10
800	2,4	4	5,6	8	10	11	12,5	
1000	3,2	5	7,1	10	12,5	14	16	
1250	4,2	6,3	9	12,5	16	18	20	
1600	5,6	8	11	16	20	22	25	

⁽¹⁾: For lower rated impulse withstand voltages, refer to Table 2 of standard IEC 61439-1.

⁽²⁾: Material groups are classified as follows, according to the range of Comparative Tracking Index (CTI) values:

- Material Group I: $600 \leq CTI$,
- Material Group II: $600 \leq CTI$,
- Material Group IIIa: $600 \leq CTI$,
- Material Group IIIb: $600 \leq CTI$.



SERIES INDIVIDUAL VERIFICATIONS

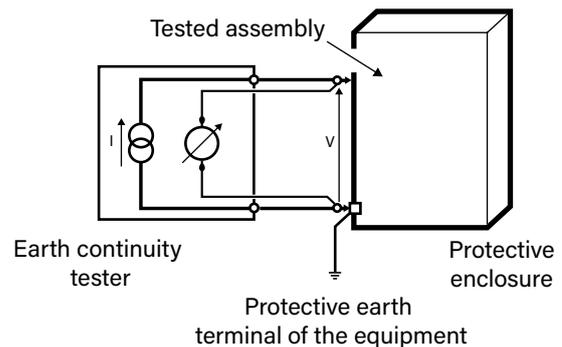
Article 11.4 - Protection against electric shock and integrity of protective circuits

Two levels of protection must be considered:

- **Basic protection** (risk of direct contact with live parts normally under voltage). This protective measure is generally achieved using insulating or non-insulating enclosures, or barriers (screens) preventing access to these hazardous parts.
- **Fault protection** (risk of indirect contact with a normally inactive and accessible conductive part). This additional protective measure ensures the safety of persons against the effects of a fault inside the PSA and even a fault on an external circuit powered by the PSA.

CONTINUITY TEST PRINCIPLE

The measurement is carried out at 10 A, the resistance must not exceed 0.1 Ω .



Each PSA must include a protective circuit to ensure the automatic disconnection of the power supply in the event of a fault. This protective circuit must imperatively connect all accessible exposed conductive parts. When certain exposed parts of a PSA cannot be directly connected to the protective circuit (loss of continuity) using standard PSA connection components, a conductor of appropriate cross-section must ensure their connection. Reminder: This protective circuit must be able to withstand the short-circuit stresses that may occur at the PSA installation point.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

It must be verified that the various exposed conductive parts of the assembly are effectively connected to the terminal of the incoming external protective conductor.

The verification can be carried out by actual visual inspection, and when this is not possible, the verification must be performed by a 10 A test (alternating or direct current) followed by a resistance measurement that must not exceed 0.1 Ω .

The tightening of screwed and bolted joints must be randomly checked by sampling. The tightening torques are available in our technical documentation.



The assembly of the enclosures ensures the continuity of exposed conductive parts.



It is recommended to limit the test duration when low-power equipment may be affected by the test.



Article 11.5 - Integration of Connection Devices and Components

All components incorporated into an assembly must be suitable for their intended use and comply with the relevant IEC standards. The electrical characteristics of the devices (rated voltage, current, frequency, making and breaking capacity, short-circuit withstand, insulation voltage, rated impulse withstand voltage, etc.) must meet the specifications and installation conditions of the assembly.

For example, for a low-voltage main switchboard specified for an operating voltage $U_e = 400\text{ V}$, and therefore intended for use on a 400 V network, no product within the assembly should have an insulation voltage U_i lower than 400 V.

Likewise, its main switch must, among other requirements, be rated for the short-circuit current. Any information regarding the associated protection must appear on the nameplate and in the technical file.

Adjustment and reset devices, as well as connection terminals, must be easily accessible.

Busbars must be designed and sized to withstand short-circuit stresses.

Conductors must be sized according to the rules of IEC 60364-5-52, adapted to the conditions inside the assembly.

All products must be installed according to the manufacturer's instructions.

A workshop book for building assemblies compliant with IEC 61439-2 will be made available on the online catalog at legrand.com

Specific recommendations for enclosures, splicing systems, and their accessories are described in detailed guides and product manuals.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

The assembly manufacturer must ensure that the products and their identification comply with the assembly specifications and that their implementation follows the original manufacturer's instructions. This verification is carried out through a visual inspection.

They must also compile the technical file with manuals and other instructions provided by the original manufacturer.



The workshop guides provide assembly instructions and additional information for selecting and installing equipment, accessories, and distribution systems.

► The workshop guides can be downloaded from the website www.legrand.com



INDIVIDUAL SERIES VERIFICATIONS

Article 11.6 - Internal Electrical Circuits and Connections

Busbars and power circuit conductors must be sized and installed according to the prospective short-circuit current that may occur at the assembly's installation point.

For the selection and sizing of busbars, refer to the workshop guides or the XL Pro4 software. The selection of conductors must comply with the requirements of IEC 60364-5-52.

In certain conditions, the cross-section of neutral conductors may be reduced.

Neutral conductors must be identifiable by their color.

Auxiliary circuits must be protected against the effects of short circuits or must be implemented in such a way that a short circuit is not to be feared.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

The tightening of connections and terminals must be randomly checked by sampling.

A visual inspection must be carried out on the finished assembly. Compliance with the wiring diagram and conductor identification is the responsibility of the assembly manufacturer.

TIGHTENING TORQUE VERIFICATION CAMPAIGN



Tightening torque verification.

+ The use of Legrand's HX³ and VX³ horizontal and vertical distribution systems (busbars, power supply and connection kits, row distribution blocks) simplifies wiring and compliance verification with the standard.



Article 11.7 - Terminals for External Conductors

The number, type, and identification of terminals must be verified in accordance with the assembly manufacturing instructions.

Conductors must not be subjected to stresses that could reduce their normal service life.

The assembly manufacturer must indicate whether the terminals are suitable for copper conductors, aluminum conductors, or both.

Terminals must allow external conductors to be connected using a method (screws, connectors, etc.) that ensures the necessary contact pressure is maintained, corresponding to the rated current and the short-circuit withstand of the device and circuit.

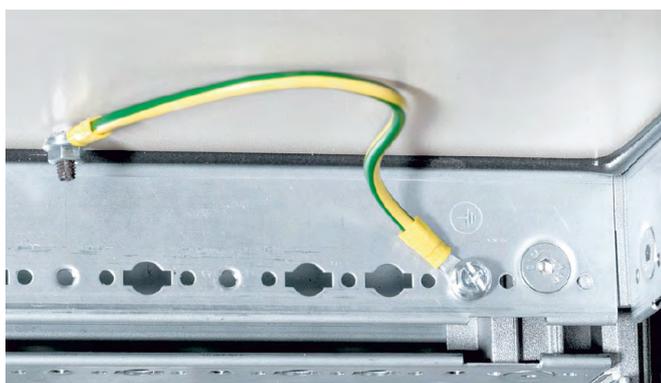
External conductor terminals must be marked in accordance with IEC 60445.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

The assembly manufacturer must verify all types of terminals that may be used for cable entry or exit (Neutral, PEN, etc.) and ensure they are suitable for copper or aluminum conductors, or both.

The identification of external conductor terminals must be carried out.

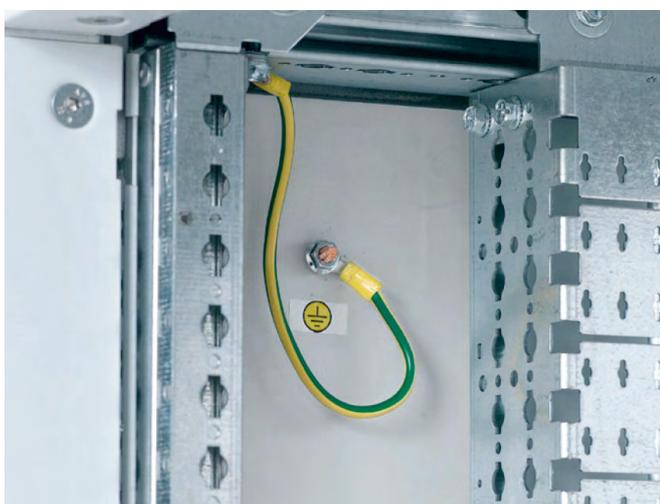
A visual inspection must be performed on the finished assembly.



Example: The connection points of the type A equipotential bonding are identified by the symbol shown opposite.



Example: Phases must, at a minimum, be marked N, L1, L2, L3 at the ends and connection points.



INDIVIDUAL SERIES VERIFICATIONS

Article 11.8 - Mechanical Operation

The proper operation of mechanical control devices, interlocks and locking mechanisms, including those associated with removable or movable parts, must be verified.

Opening a door or a removable cover must not alter the operating conditions and reliability of the devices or control elements potentially affected by such movement.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

The mechanical operation of doors and hinged front plates must be checked, as well as the mechanical control elements, interlocks and locking mechanisms, including those associated with removable parts.

The number of operating cycles must be equal to 200.



► Available in the online catalog at [legrand.com](https://www.legrand.com)



The test is considered satisfactory if the devices and interlocks are still in good working condition, if the specified degree of protection has not been affected, and if the operating force required is practically the same as before the test.



Article 11.9 - Dielectric Properties

Dielectric tests assess insulation performance for the maximum operating voltage. They are carried out at the industrial frequency of 50 Hz.

 Alternatively, for assemblies with an incoming current protection rating less than or equal to 250 A, an insulation resistance measurement may be performed using an insulation measuring device at a voltage of at least 500 V DC.

In this case, the test is considered satisfactory if the insulation resistance between circuits and exposed conductive parts is at least 1000 Ω/V , based on the supply voltage of these circuits relative to earth.



All components containing electronics must be disconnected to avoid any damage or destruction. DPX³ devices with integrated residual current protection or differential blocks, and DMX³ 1600 with MP 2.10 or MP 4.10 protection units, have a dielectric test selector to protect the embedded electronics. DMX³ 2500/4000/6300 devices have a built-in dielectric test function in the MP 2.10 and MP 4.10 protection units.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

The dielectric test must be carried out according to the instructions or requirements related to the assembly.

- Industrial frequency test for a declared insulation value U_i .
- Impulse voltage test (1.2/50 μs wave) for a declared value U_{imp} .

The tested assembly must be de-energized, and no receiving device must be connected.

All switching devices must be in position I (ON).

The test voltage is applied in the following sequence:

- between each pole of every circuit (power, control, auxiliary) and the assembly's exposed conductive parts;
- between each pole of the main circuit and the other poles (between each phase and between each phase and the neutral);
- between each circuit if they are not electrically connected (e.g., separate control circuit or SELV and main circuit);
- between the protective circuit and the exposed conductive parts for Class II assemblies;
- between disconnected or separated parts for the disconnection function.



INDIVIDUAL SERIES VERIFICATIONS

Article 11.9 - Dielectric Properties (continued)

TABLE 8 - POWER-FREQUENCY WITHSTAND VOLTAGE FOR MAIN CIRCUITS (10.9.2)

Rated insulation voltage U_i (between phases AC or DC) (V)	RMS AC dielectric test voltage (V)	Peak AC dielectric test voltage (V)
$U_i \leq 60$	1000	1415
$60 < U_i \leq 300$	1500	2120
$300 < U_i \leq 690$	1890	2670
$690 < U_i \leq 800$	2000	2830
$800 < U_i \leq 1000$	2200	3110
$1000 < U_i \leq 1500^a$	2700	3820

a : for direct current only

TABLE 9 - POWER-FREQUENCY WITHSTAND VOLTAGE FOR AUXILIARY AND CONTROL CIRCUITS (10.9.2)

Rated insulation voltage, U_i (between phases) (V)	RMS AC dielectric test voltage (V)	DC dielectric test voltage (V)
$U_i \leq 12$	250	355
$12 < U_i \leq 60$	500	710
$60 < U_i$	See Table 8	See Table 8



Article 11.10 - Wiring, Electrical Operation and Function

It is necessary to verify that the information and markings specified are complete.

The assembly manufacturer must be able to identify each assembly with a nameplate, marked in a durable manner and placed in an easily visible location when the assembly is installed and in operation.

Depending on the complexity of the assembly, it may be necessary to examine the wiring and perform an electrical operation test.

The test procedure and number of tests depend on whether there are interlocks, complex control sequences, etc.

WHAT THE ASSEMBLY MANUFACTURER MUST DO

Information and markings must be verified.

A functional test is necessary before putting the assembly into service.

The following information must be found on the nameplate:

- Name of the assembly manufacturer or brand (responsible for final assembly),
e.g.: Company Name;
- Designation of type or identification number,
e.g.: TD01 - RDC or 918732;
- Date of manufacture identification,
e.g.: 2015 or 2015 - 03 or 12W09 IEC 61439-X (the specific part X identified),
e.g.: IEC 61439-2.

Example of nameplate:

Nameplate	TD01 - RDC
2015	IEC 61439-2

The following additional information should be provided in the technical documentation supplied with the assembly (technical file):

- Rated voltage of the assembly (U_n),
ex: $U_n = 400\text{ V}$;
- Rated operational voltage (U_e),
e.g.: $U_e = 230\text{ V}$ (if different from U_n);
- Rated impulse withstand voltage (U_{imp}),
e.g.: $U_{imp} = 6\text{ kV}$;
- Rated insulation voltage (U_i),
e.g.: $U_i = 800\text{ V}$;
- Rated current of the assembly (I_{na}),
e.g.: $I_{na} = 3100\text{ A}$;
- Rated current of a circuit (I_{nc}),
e.g.: $I_{nc} = 250\text{ A}$;
- Peak withstand current rating (I_{pk}),
e.g.: $I_{pk} = 140\text{ kA}$;
- Short-time withstand current rating (I_{cw}),
e.g.: $I_{cw} = 50\text{ kA/1 s}$;
- Conditional short-circuit current rating (I_{cc}),
ex: $I_{cc} = 70\text{ kA}$;
- Frequency rating (f_n),
e.g.: $f_n = 50\text{ Hz}$;
- Diversity factor (RDF).
ex: $RDF = 0,7$.

In certain cases, it may be necessary to carry out or repeat this test on-site before commissioning the installation.

All technical information mentioned opposite must, where applicable, be compiled in the technical file or documentation of the assembly manufacturer and delivered with the assembly.

The assembly manufacturer must also specify any conditions for handling, installation, operation, and maintenance of the assembly and the equipment it contains. For this purpose, a logistics guide and a maintenance guide are available.

To assist with this, sample compliance letters and inspection certificates are provided on ► [pages 28 to 29](#)

A sample inspection report is available in the online catalog at [legrand.com](#)

All documents are available in the online catalog at [legrand.com](#)



DECLARATION OF CONFORMITY

GENERAL INFORMATION

Company name:

Address:

Recipient:

Document No.: Date:

Assembly No.: Date:

STANDARD IEC 61439-2

The undersigned manufacturer hereby certifies that the power switchgear assembly designated above has been constructed in compliance with the requirements of standards IEC 61439-2 / IEC 61439-1.

The implementation of the components used has been carried out in accordance with the original manufacturer's instructions, with reference to the design verifications performed according to IEC 61439-2:

- ▶ Verification of the strength of materials and parts
- ▶ Verification of the degree of protection
- ▶ Verification of clearances and creepage distances
- ▶ Verification of the effectiveness of the protective circuit
- ▶ Verification of component integration
- ▶ Verification of the electrical circuit and connections
- ▶ Verification of terminals for external conductors
- ▶ Verification of dielectric properties
- ▶ Verification of temperature rise limits
- ▶ Verification of short-circuit withstand capability
- ▶ Verification of electromagnetic compatibility
- ▶ Verification of mechanical operation

Routine individual verifications are documented in individual inspection report No including, in accordance with the standard:

- ▶ Visual inspection of degree of protection
- ▶ Visual inspection of clearances
- ▶ Visual inspection of creepage distances
- ▶ Verification of protective circuits
- ▶ Visual inspection of integrated components
- ▶ Spot check of connections
- ▶ Visual inspection of terminals for external conductors
- ▶ Verification of mechanical operation
- ▶ Industrial frequency withstand test (duration: 1 s)
- ▶ Visual inspection of information and markings + functional test

The Declarant:

Signature:



INSPECTION CERTIFICATE

LIST OF OPERATIONS TO BE CARRIED OUT BY THE ASSEMBLY MANUFACTURER ACCORDING TO STANDARD IEC 61439-2

Assembly name: Order number:

Individual Tests	Done	Not applicable
1. Equipment Inspection		
1.1. Consistency between the electrical drawing and the switchboard assembly	<input type="checkbox"/>	<input type="checkbox"/>
1.2. Consistency between the installed equipment and the component reference list	<input type="checkbox"/>	<input type="checkbox"/>
1.3. Visual inspection of the enclosure's degree of protection (art. 11.2)	<input type="checkbox"/>	<input type="checkbox"/>
1.4. Verification of air clearance distances with 50 Hz voltage test (art. 11.3)	<input type="checkbox"/>	<input type="checkbox"/>
1.5. Verification of surface clearance distances (creepage distances) by physical or visual measurement (art. 11.3)	<input type="checkbox"/>	<input type="checkbox"/>
1.6. Verification of surface clearance distances (creepage distances) by physical or visual measurement (art. 11.3)	<input type="checkbox"/>	<input type="checkbox"/>
1.7. Verification of proper installation of devices (art. 11.5)	<input type="checkbox"/>	<input type="checkbox"/>
1.8. Sampling verification of electrical connections (art. 11.6)	<input type="checkbox"/>	<input type="checkbox"/>
1.9. Verification of terminals for external conductors (art. 11.7)	<input type="checkbox"/>	<input type="checkbox"/>
1.10. Verification of proper mechanical operation (art. 11.8)	<input type="checkbox"/>	<input type="checkbox"/>
2. Verification of Protective Circuit Continuity (art. 11.4)		
2.1. Visual verification of interconnections if possible	<input type="checkbox"/>	<input type="checkbox"/>
2.2. Otherwise, perform a test at 10 A (AC or DC) to measure a resistance less than or equal to 0.1 Ω (see clause 10.5.2 of the standard)	<input type="checkbox"/>	<input type="checkbox"/>
3. Dielectric and Insulation Test (art. 11.9)		
3.1. Test voltage 1890 Vrms 50 Hz with application time of 1 s	<input type="checkbox"/>	<input type="checkbox"/>
3.2. Test voltage 500 V with resistance greater than 1000 Ω/V (relative to supply voltage)	<input type="checkbox"/>	<input type="checkbox"/>
4. Wiring and Performance Under Operating Conditions (art. 11.10)		
4.1. Main circuit with full insertion of circuits	<input type="checkbox"/>	<input type="checkbox"/>
4.2. Phase sequence	<input type="checkbox"/>	<input type="checkbox"/>
4.3. Auxiliary circuits with full insertion of equipment	<input type="checkbox"/>	<input type="checkbox"/>
4.4. Operation of control devices	<input type="checkbox"/>	<input type="checkbox"/>
4.5. Tripping of residual current devices using test function	<input type="checkbox"/>	<input type="checkbox"/>
4.6. Reading and checking of instrumentation	<input type="checkbox"/>	<input type="checkbox"/>
5. Final Inspection		
5.1. Verification of the correspondence of the applied labels	<input type="checkbox"/>	<input type="checkbox"/>
5.2. Retrieval and addition of the documentation to be attached	<input type="checkbox"/>	<input type="checkbox"/>

Person present at the inspection:

Person present at the inspection:

Inspector's name: Date:

Signature:





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