# 1 - INTRODUCTION

A – General

The aim of this standard (IEC 61439) is to harmonize, as far as practice allows, all the rules and requirements of a general nature which are applicable to low voltage switchgear assemblies (ASSEMBLIES) in order to obtain consistency of requirements and verification for ASSEMBLIES and to avoid any verification required under other standards.

All the requirements relating to the various standards applicable to ASSEMBLIES which can be considered to be of a general nature have thus been brought together in this basic standard with specific aspects whose scope and application are extensive, for example, the heating, dielectric properties, etc ...

The requirements of the standard which are subject to agreement between the ASSEMBLY manufacturer and the user are gathered in Annex B (informative) of part 2 of power switchgear assemblies..

 **Standard IEC 61439 - 1 and 2 / NF EN 61439**

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| --- | --- | --- |
| **‐****‐** **‐** | IEC 61439-1IEC 61439-2IEC 61439-3 | General rulesPOWER EQUIPMENT ASSEMBLIES (EAP)Distribution tables ≤ 250A domestic or similar (DBO\*) |
| **‐** | IEC 61439-4 | Construction ASSEMBLIES |
| **‐** | IEC 61439-5 | ASSEMBLIES for the distribution of electrical energy |
| **‐** | IEC 61439-6 | Prefabricated pipes |
| **‐** | IEC 61439-7 | Special public installations (camping, marinas) |
| **‐** | IEC 61439-8 | Machineries (project) |

\*DBO : Distribution Board Intended to be operated by ordinary persons. (Allocation tables intended for use by ordinary people)

They define the general rules for ASSEMBLIES whose design is verified by completely eliminating the old categories ES and EDS.

B – Power Equipment Assemblies (part 2 of the standard)

Part 2 of IEC 61439, based on part 1 of the general rules, defines the specific requirements applicable to power switchgear assemblies (EAP ASSEMBLIES) as follows:

- ASSEMBLIES whose rated voltage does not exceed 1000 V in alternating current or 1500 V in direct current;

- Fixed or mobile ASSEMBLIES with or without enclosure;

- ASSEMBLIES intended for use with equipment designed for the production, transport, distribution and conversion of electrical energy and the control of equipment consuming electrical energy;

- ASSEMBLIES designed for use under special conditions of employment, for example on board ships and rail vehicles, provided that the other corresponding specific requirements are met;

- ASSEMBLIES designed for the electrical equipment of machines. Additional requirements for ASSEMBLIES forming part of a machine are covered by the IEC 60204 series.

This standard applies to all ASSEMBLIES whether they are designed, manufactured and tested individually or whether they are completely standardized and manufactured in quantity.

Manufacturing and / or assembly can be performed by a third party who is not the original driver.

The old IEC 60439 standard had a part for each type of ASSEMBLY.

With the new IEC 61439 standard, it takes two parts to define each type of ASSEMBLY. The conformity of an ASSEMBLY refers to:

- To the specific standard relating to ASSEMBLIES. Ex: IEC 61439-2 (part 2)

- To the general rules IEC 61439-1 (part 1) always implicitly.

ES and EDS switchgear are replaced by PSC sets or Power switchgear sets (IEC 61439-2). ASSEMBLY whose design is verified.

There is consistency with the switchgear standards relating to IEC \* or NF EN \*\* 60947-x switchgear assemblies.

\* IEC: International Electrotechnical Commission

\*\* NF-EN: French standard European standard

PART 1: this part covers general rules and cannot be used alone to specify a SET. These are the basic rules common to the other parties.

PART 2: this part defines the specific requirements relating to power switchgear assemblies (PSC \* ASSEMBLIES)

This is the only part that has a dual role, it covers PSC ASSEMBLIES and any ASSEMBLY that is not covered by other specific parts.

\* PSC: Power Switch Control or EAP: Power Equipment Set

IEC 61439-1 and 2 standards apply to enclosures for which the rated voltage is less than:

- 1000 V AC (max 1000 Hz)

- 1500 V DC

**Sharing of responsibilities:**

New terms have been applied and there is a division of product responsibilities between:

1. - the constructor :

He is responsible for the execution of the original design and the associated verification of an ASSEMBLY which he has designed.

It assumes the construction or performance characteristics: resistance of the materials and of the assembly, degree of protection of the assembly, isolation distances and creepage lines, protection against electric shocks and the integrity of the protection circuits, integration of connection elements and components, internal electrical circuits and connections, terminals for external connectors, dielectric properties at industrial frequency and impulse withstand voltage, verification of temperature rise resistance, short-circuit withstand, electromagnetic compatibility (EMC) , mechanical operations.

 the

2- the manufacturer or constructor of assemblies

These are panel builders using an ASSEMBLY system from an original manufacturer.

The defined assembly rules must be observed. Use of kits and accessories tested by the original manufacturer.

He assumes responsibility for the ASSEMBLY produced (Complete assembled-wired assembly) :

 - The choice and assembly of components in full compliance with the instructions provided,

 - Performing the periodic verification on each assembly manufactured,

 - Approval of the assembly - List of prescribed tests:

 • IP protection degree of the enclosure

 • Isolation distances and creepage lines

 • Protection against electric shock and integrity of protection circuits

 • Integration of connection elements and components

 • Internal electrical circuits and connections

 • Terminals for external connectors

 • Mechanical operations

 • Dielectric properties at power frequency and impulse withstand voltage

 •Wiring

 • Operation

 •Functioning

The assembly manufacturer may be a different organization from the original manufacturer.

If the assembly manufacturer makes changes to the configuration of the assembly tested by the original manufacturer, then he becomes the original manufacturer with regard to those changes and must perform the design verification.

In terms of liability, the general and obvious rule is: The manufacturer of the ASSEMBLY is responsible for the ASSEMBLY.

In practice, it has two options:

 1 - He decides to manufacture the ASSEMBLY according to the rules of the original manufacturer.

In this case, the ASSEMBLY manufacturer must perform only the second verification step, namely the individual series verification.

 2 - He decides not to manufacture the ASSEMBLY according to the rules of the original manufacturer. In this case, the ASSEMBLY manufacturer incorporates its own provisions and is thus considered to be the original manufacturer.

With regard to these provisions, he must then carry out the first and second verification stages:

 Verification of the design and individual verification of the series.

# - Internal separations of "EAP" assemblies (Power Equipment Assemblies)

Internal separations of "EAP" assemblies (Power Equipment Assemblies)

The partitions within an assembly by means of screens or partitions are expressed by representative forms of partitions. Forms 1 - 2a - 2b - 3a - 3b provide the required level of security and availability.

Below is an example of construction for each Form defined by standard 61439-2 (chap. 8.101 and appendix AA).

**SECURITY**

**AVAILABILITY**

No separation No access to live parts, but

**Form 1**

 control through door (front reference) therefore addition of a door if installation in ambient..

None, any intervention inside the enclosure imposes a de-energization of the column in question.

 Separation of the busbars from the Functional Units.

Terminals for external conductors do not need to be separated from the busbars.

**Form 2b**

**Form 2a**

No access to live parts in the volume of the Functional Units.

High human risks during interventions in the cable box (presence of the Vertical JdB).

Human risks when accessing a Functional Unit (external events of neighbouring UFs)Good intervention on a UF without general cut-off.

According to the manufacturers, the Form 2 can look like a Form 3 (board technology)

Separation of the busbars from the Functional Units.

Terminals for external conductors need to be separated from the busbars..

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No access to live parts. Human risks when accessing a UF (external manifestations of neighbouring UFs

Good intervention on a UF without general cut-off.

According to the manufacturers, the Form 2 can look like a Form 3 (board technology)

Separation of busbars from functional units and separation of all functional units from one another. Terminals for external conductors do not need to be separated from the busbars.

**Form 3a**

No access to live parts.

High human risks when working in the cable box (presence of the vertical bus).

No human risk when accessing a UF.Good intervention on a UF without general cut-off.

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**SECURITY**

**AVAILABILITY**

Separation of busbars from functional units and separation of all functional units from one another.

**Form 3b**

Separation of terminals for external conductors from functional units but not from each other..

No access to live parts.

No human risks when accessing a UF.

Good intervention on a UF without general cut-off.

Separation of the busbars from the functional units and separation of all functional units from each other, including the terminals for external conductors, which are an integral part of the UF.

**Form 4a**

No access to live parts.

No human risk when accessing a UF and its associated cable outlet.Maximum availability, intervention on a UF and its cable outlet without general cut.

Separation of busbars from functional units and separation of all functional units from each other, including terminals for external conductors.

**Form 4b**

Separation of terminals for external conductors.

No access to live parts.

No human risks when accessing a UF and its associated cable outlet.

Maximum availability, intervention on a UF and its cable outlet without general cut

# - Protection against contact with active parts, against the ingress of solid foreign bodies and water. (61439-1 chap 8.2.2 and 10.3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **1st digit: protection against solid objects** |  |  | **2nd digit: protection against liquids** |  |
| IP |  |  | IP |  |
| 0 | No protection |  | 0 | No protection |
| 1 | Protected against solid objects greater than 50 mm (involuntary hand contact) |  | 1 | Protected against vertically falling drops of water (condensation) |
| 2 | Protected against solid objects larger than 12 mm (the finger of one hand) |  | 2 | Protected against falling water drops up to 15 ° from the vertical |
| 3 | Protected against solid objects greater than 2.5 mm (tools, wires) |  | 3 | Protected against rain up to 60 ° from vertical |
| 4 | Protected against solid objects greater than 1 mm |  | 4 | Protected against splashing water from all directions |   |
| 5 | Protected against dust (no harmful deposits) |  | 5 | Protected against jets of water coming from all directions and projected by a lance |  |
| 6 | Fully protected against dust |  | 6 | Protected against jets of water similar to sea waves |  |
|  |  |  | 7 | Protected against the effects of temporary immersion |  |
|  |  |  | 8 | Protected against the effects of |  |



**Protection indices obtainable with tables**

The degree of protection is defined by 2 digits and possibly by an optional additional letter. We write for example: IP or IP xx B (x meaning: any value)

The additional letter defines access to dangerous parts only.

Example: a device has an opening allowing access with a finger. It will not be rated IP 2x. On the other hand, if the parts accessible to the finger are not dangerous (electric shock, burns ...), the device can be classified xx B*.*

|  |  |
| --- | --- |
| **ADDITIONAL LETTER** | **DEGREES OF PROTECTION****Short description** |
| A | Protected against access with the back of the hand |
| B | Protected against access with the finger |
| C | Protected against access with a tool |
| D | Protected against access with a wire |

##  MECHANICAL IMPACT RESISTANCE IK (61439-2 chapter 8.2.1 - mechanical impacts)

Impact energy in Joule **1.00**

Impact energy in Joule **2.00**

Impact energy in Joule **5.00**

Impact energy in Joule **10.00**

Impact energy in Joule **20.00**

**IK 10**

**IK 09**

**IK 08**

**IK 07**

**IK 06**

Unprotected

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**IK 0**

Impact energy in Joule **0.140**

Impact energy in Joule **0.200**

Impact energy in Joule **0.350**

Impact energy in Joule **0.500**

**IK 04**

**IK 03**

**IK 02**

**IK 01**

Impact energy in Joule **0.700**

Code *IK* : - NF EN 62262 (NF.C 20 015)

- IEC 62262 Code *IP* : - IEC 60529 E2.1

**IK 05**

# 5 - Types of electrical connections of the Functional Units (UF)

UF: part of an assembly comprising all the mechanical and electrical elements, including connection devices, which contribute to the performance of a single function.

YESTERDAY:

Standard NF 63412 Definition of the MPC index:

M: Connection mode (1 to 6)

P: Protection against direct contact (1 to 4)

C: Partition

TODAY:

* Standard NF EN 61439-2 chapter 8.5.101
* Upstream 1st letter: main arrival circuit F : fixed connections

* Downstream 2nd letter: main starting circuit D : disconnectable connections
* Auxiliary 3rd letter: Auxiliary circuit

W : withdrawable connections

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*Examples :*

The most common mobility indices

Upstream Downstream Auxiliary



Upstream Downstream

Auxiliary

FFF

Fixe

WWW

Withdrawal

On plinth or drawer

 Upstream

 Downstream

 Auxiliary

 Upstream

 Downstream

 Auxiliary

WFD

Disconnectable

DDD