

INTERNATIONAL STANDARD



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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –**Part 5: Assemblies for power distribution in public networks**

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61439-5:2014. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 61439-5 has been prepared by subcommittee 121B: Low-voltage switchgear and controlgear assemblies, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage. It is an International Standard.

This third edition cancels and replaces the second edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) omission of the requirement to conduct mechanical tests at -25 °C when enclosures are made of a metallic material;
- b) addition of assumed loading factors generation supplies and electric vehicle charging applications;
- c) additional dielectric tests when a PENDA is used in a distribution substation with separate HV and LV earths;
- d) further clarification of representative samples for design verification.

The text of this International Standard is based on the following documents:

Draft	Report on voting
121B/173/FDIS	121B/178/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This document is to be read in conjunction with IEC 61439-1. The provisions of the general rules dealt with in IEC 61439-1 are only applicable to this document insofar as they are specifically cited. When this document states "addition", "modification" or "replacement", the relevant text in IEC 61439-1:2020 is to be adapted accordingly. Subclauses that are numbered with a 101 (102, 103 etc.) suffix are additional to the same subclause in IEC 61439-1:2020.

Tables and figures in IEC 61439-5:2023 that are new are numbered starting with 101.

New annexes in IEC 61439-5:2023 are lettered AA, BB, etc.

The reader's attention is drawn to the fact that Annex DD lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

A list of all parts of the IEC 61439 series, under the general title *Low-voltage switchgear and controlgear assemblies* can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part 5: Assemblies for power distribution in public networks

1 Scope

This document defines the specific requirements for public electricity network distribution assemblies (PENDAs).

PENDAs have the following criteria:

- used for the distribution of electrical energy in three phase systems for which the rated voltage does not exceed 1 000 V AC (see Figure 101 for a typical distribution network) and DC systems not exceeding 1 500 V DC;
- stationary;
- open type assemblies are not covered by this document;
- suitable for installation in places where only skilled persons have access for their use, however, outdoor types ~~may~~ can be installed in situations that are accessible to ordinary persons
 - intended for use in energy distribution in public power grids;
 - indoor use: assemblies for installation inside of electric power substations;
 - outdoor use: assemblies containing an enclosure suitable for open air installation.

The object of this document is to state the definitions and to specify the service conditions, construction requirements, technical characteristics and tests for PENDAs. ~~Network parameters may require~~ Tests at higher performance level can be applicable with some network parameters.

PENDAs ~~may~~ can also include control and or signalling devices associated with the distribution of electrical energy.

NOTE 1 Control and monitoring devices can be used in smart grid applications or the transmission of smart grid data.

This document applies to all PENDAs whether they are designed, manufactured on a one-off basis or fully standardised and manufactured in quantity.

The manufacture and/or assembly ~~may~~ can be carried out other than by the original manufacturer (see 3.10.1 of IEC 61439-1:2014/2020).

This document does not apply to individual devices and self-contained components, such as motor starters, fuse switches, electronic equipment, etc. which comply with the relevant product standards.

If the substation is owned or operated by a public distribution system operator (DSO), PENDA's which are used as LV distribution panels in transformer substations are within the scope of this document,

This document does not apply to specific types of assemblies covered by other parts of IEC 61439 series.

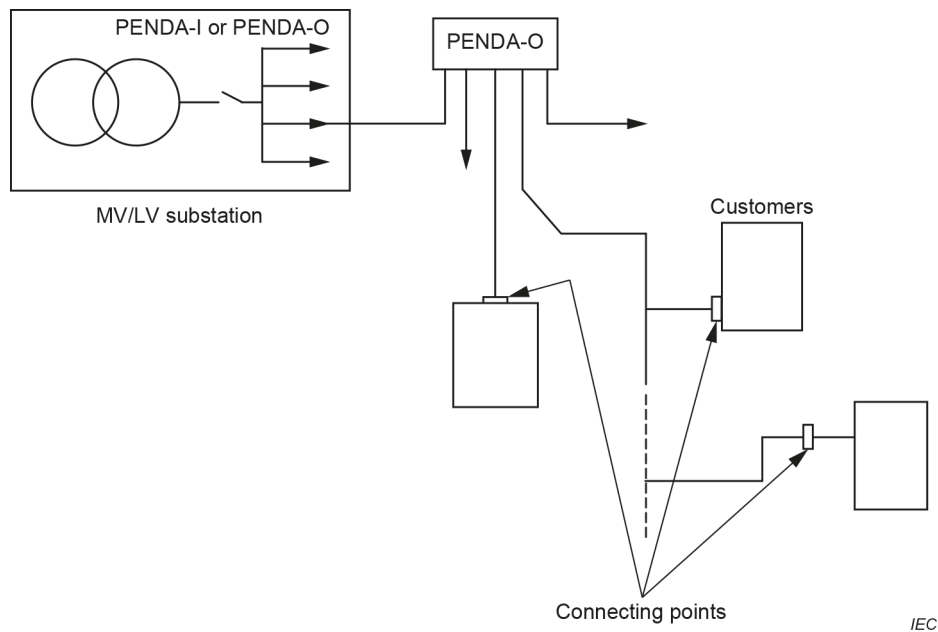


Figure 101 – Typical distribution network

NOTE 2 If a PENDA is equipped with additional equipment (for example meters), in such a way that the main function is changed considerably, then other standards can also apply as agreed between user and manufacturer (see 8.5 of IEC 61439-1:2014/2020).

NOTE 3 Where local regulations and practices permit, a PENDA according to this document can be used in other than public networks.

NOTE 4 DSO's can define additional requirements for their PENDA's.

2 Normative references

This clause of IEC 61439-1:2020 applies except as follows.

Addition:

IEC 60695-11-10:2013, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 61439-1:2014/2020, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

ISO 9223:2012, *Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, determination and estimation*

ISO 6506-1:2014, *Metallic materials – Brinell hardness test – Part 1: Test method*

3 Terms and definitions

This clause of IEC 61439-1:2020 applies except as follows.

3.1 General terms

Additional terms:

3.1.101

public electricity network distribution assembly PENDA

assembly, generally for installation in a public electricity network which in use, receives electrical energy from one or more supplies and distributes that energy through one or more cables to other equipment

Note 1 to entry: A PENDA is installed, operated and maintained solely by skilled persons.

Note 2 to entry: Some types of a PENDA were previously known as a cable distribution cabinet (CDC).

3.1.101.1

outdoor public electricity network distribution assembly PENDA-O

cubicle type public electricity network distribution assembly that is suitable for outdoor installation in places that ~~may~~ can, or ~~may not~~ cannot, be accessible to the public

3.1.101.2

indoor public electricity network distribution assembly PENDA-I

public electricity network distribution assembly suitable for installation indoors, generally without an enclosure, but including all structural parts necessary to support busbars, functional units and other ancillary devices, necessary to complete the assembly

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3.1.102

design life

minimum duration for which specified performance characteristics of equipment are expected when the equipment is operated as intended and regularly maintained by instructed persons in accordance with the manufacturer's instructions

[SOURCE: IEC 60050-395:2014, 395-07-93, modified – Note to entry omitted and 'granted' replaced by 'expected when instructions'.]

3.3 External design of assemblies

3.3.1

open-type assembly

This term of IEC 61439-1:2020 does not apply.

3.9 Verification

Modifications:

3.9.1

design verification

Delete the note.

3.9.1.2

verification comparison

This term of IEC 61439-1:2020 does not apply.

3.9.1.3**verification assessment**

This term of IEC 61439-1:2020 does not apply.

4 Symbols and abbreviations

This clause of IEC 61439-1:2020 applies.

5 Interface characteristics

This clause of IEC 61439-1:2020 applies, except as follows.

5.4 Rated diversity factor (RDF)

Addition:

In the absence of an agreement between the assembly manufacturer and user concerning the actual load currents, the assumed loading of the outgoing circuits of the assembly or group of outgoing circuits ~~may~~ can be based on the values given in Table 101.

For distribution and final circuits, it is assumed that the load current is the rated current of the protective device, I_n , as required by the user, multiplied with the loading factor of Table 101.

Table 101 – Values of assumed loading

Number of main circuits	Assumed loading factor
2 and 3	0,9
4 and 5	0,8
6 to 9 inclusive	0,7
10 (and above)	0,6

Application	Assumed loading factor
Regular distribution grid connections 2 to 3 circuits	0,9
Regular distribution grid connections 4 to 5 circuits	0,8
Regular distribution grid connections 6 to 9 circuits	0,7
Regular distribution grid connections ≥ 10 circuits	0,6
Generation supply (e.g. PV, wind farm, biomass)	1,0
Charging infrastructure for EV	1,0

6 Information

This clause of IEC 61439-1:2020 applies except as follows.

6.1 Assembly designation marking

Addition to first paragraph:

Designation plates ~~may~~ can be placed inside an enclosure of an assembly provided their intended place ensures good legibility and visibility when the door(s) is(are) open or the cover is removed.

Replacement of item dg):

dg) IEC 61439-5.

6.3 Device and/or component identification

Additional paragraph:

In the case of removable fuse-carriers which are specific to a fuseway, a label shall be placed on the fuse carrier as well as on the fuse base, to avoid incorrect interchangeability of the fuse-carrier.

Additional subclause:

6.101 Circuit identification

It shall be possible to identify each functional unit in a clearly visible manner.

7 Service conditions

This clause of IEC 61439-1:2020 applies except as follows.

7.1 Normal service conditions

7.1.1 Climatic conditions

Addition to the first paragraph:

Unless the user specifies that a PENDA shall be suitable for use in an arctic climate, the lower limit of ambient air temperature is -25 °C as specified in Table 15 of IEC 61439-1:2020. For an arctic climate the lower limit of ambient temperature is -50 °C .

~~7.1.1.2 Ambient air temperature for outdoor installations~~

~~*Replacement of last paragraph with:*~~

~~Unless the user specifies a PENDA shall be suitable for use in an arctic climate, the lower limit of ambient air temperature is -25 °C . For an arctic climate the lower limit of ambient temperature is -50 °C .~~

7.1.2 Pollution degree

Replace the first paragraph with the following:

The pollution degree referred to in Annex BB is the macro-environmental condition for which the assembly is intended.

7.2 Special service conditions

Addition of the following note to item h):

~~NOTE—Exposure to vibration arising from traffic and/or occasional ground excavation is a normal service condition for PENDAs.~~

Additional paragraph:

Additional requirements for a PENDA-O, to be installed where heavy snowfalls occur and where they are adjacent to areas where there is snow clearance by ploughing, are subject to agreement between manufacturer and user.

8 Constructional requirements

This clause of IEC 61439-1:2020 applies except as follows.

8.1 Strength of materials and parts

8.1.1 General

Change the reference to Annex C to Annex BB in paragraph 5 of 8.1.1 of IEC 61439-1:2020.

Addition:

A PENDA-O shall be arranged for ground mounting, transformer mounting, pole mounting, surface wall mounting or mounting within a recess within a wall, as agreed between user and manufacturer.

A PENDA ~~may~~ can be directly coupled to a transformer by means of a flange coupling or it ~~may~~ can connect to its supply by means of cable or via busbars as agreed between user and manufacturer. Outgoing circuits shall be suitable for connection by means of cables.

A ~~reliable~~ locking device shall be provided on outdoor enclosures which prevents access by unauthorized persons. ~~Doors, lids and covers shall be so designed that, after they are locked, they do not open due to subsequent moderate ground settlement, nor due to exposure to vibration arising from traffic and/or ground excavation and reinstatement works.~~ The fixings of any covers etc. which are removable for installation or maintenance operations shall only be accessible while the door(s) is (are) open.

Any auxiliary equipment, e.g. meters, relays, instruments, circuit breaker trip units, communications equipment, that can be readily replaced, are excluded from the minimum design life of a PENDA.

NOTE When applicable, a design life can be agreed between user and manufacturer, assuming it is operated as intended and regularly maintained by instructed personnel in accordance with the manufacturer's instructions.

8.1.3.2 Resistance of insulating materials to heat and fire

Additional subclause:

8.1.3.2.101 Verification of category of flammability

The insulating materials used for enclosures, barriers and other insulating parts shall have ~~flame retardant~~ flammability properties in accordance with ~~10.2.3.102 of this standard~~ 10.2.3.101.

8.1.5 Mechanical strength

Additional subclause:

8.1.5.101 Verification of mechanical strength

The mechanical properties of a PENDA-O shall comply with 10.2.101.

Parts of the PENDA-O intended to be embedded in the ground shall withstand the stresses imposed on them during installation and normal service and comply with 10.2.101.9.

~~*Additional subclause:*~~

~~8.1.101 Thermal stability~~

~~The thermal stability of a PENDA shall be verified according to 10.2.3.101.~~

8.2 Degree of protection provided by an assembly enclosure

8.2.1 Protection against mechanical impact (IK code)

Subclause 8.2.1 of IEC 61439-1:2020 does not apply.

The mechanical impact tests required by this document are at least equal to IK10 in accordance with IEC 62262 (see 8.1.5.101).

8.2.2 Protection against contact with live parts, ingress of solid foreign bodies and water (IP code)

Addition:

[IEC 61439-5:2023](#)

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Open type assemblies (IP00) are not covered by this document.

When a PENDA-O is intended to be installed in places accessible to the public, its enclosure shall, when fully-installed in accordance with the manufacturer's instructions, provide a degree of protection of at least IP34D according to IEC 60529. In other locations, the minimum level of protection shall be at least IP33.

PENDA-O's that are intended to be installed in places accessible to the public shall, unless otherwise stated by the user, be designed such that when any temporary cables are connected, the enclosure shall provide a degree of protection of at least IP23C according to IEC 60529. See 8.8.

~~8.4 Protection against electric shock~~

8.4.2.1 General

The third paragraph does not apply.

Additional subclause:

8.4.2.101 Earthing and short-circuiting means

When specified by the user, the outgoing units in an assembly shall be so constructed that they can be earthed and short-circuited in a secure manner by means of a device(s) recommended by the manufacturer, which ensures the ~~manufacturer's indicated~~ required degree of protection (IP code) is maintained for all parts of the assembly. ~~This requirement is not applicable if it could cause a safety hazard arising from the system conditions and/or operational practice.~~

8.4.3.1 Installation conditions

Additional paragraph:

~~For an assembly that is expected~~ When a user specifies the assembly is to feed overhead cable lines, outgoing units shall be designed in such a way that an attached cable(s) can be earthed at the termination(s).

8.8 Terminals for external ~~conductors~~ cables

Replacement of the first three paragraphs with the following:

In the absence of a special agreement between user and manufacturer, terminals shall be capable of accommodating cables having copper or aluminium conductors from the smallest to the largest cross-sectional area corresponding to the appropriate rated current (see Table AA.1).

The terminations for outgoing circuits shall be located so that adequate spacing is provided and to facilitate terminating the phase conductors of a cable irrespective of their lay.

When specified by the user the phase cable terminals of each outgoing circuit shall be separated from all other hazardous live parts. When the terminals of an outgoing circuit are exposed protection shall be provided against accidental contact with other hazardous live parts. Separation and protection shall be from the normal direction of access and in accordance with IPXXB of IEC 60529.

Where specified by the user, the incoming circuit shall be suitable for connection by means of either bare or insulated bars.

Additional subclauses:

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8.101 Marking as an obstacle to snow clearance

When specified by the user, ~~Where~~ a PENDA-O that is intended for use in regions where heavy snowfalls occur in accordance with 7.2, ~~or alternatively, if required by the user, it~~ shall be ~~possible to mark it~~ marked as an obstacle to snow clearance. Holders shall be provided, attached to the PENDA-O, to accommodate marking rods and it shall be possible to install and make adjustments to the position of the marking rod from outside the PENDA-O. ~~The holders shall be constructed in a manner which ensures that the holder or marking rod will give way to a mechanical force before the transmitted force to the PENDA-O's enclosure reaches the value which would adversely affect the degree of protection (IP code).~~

8.102 Ease of operation and maintenance

All parts of the assembly shall, as far as practicable, be readily accessible and replaceable without excessive dismantling. ~~The conditions for interchangeability of parts of the ASSEMBLY may be subject to an agreement between the user and the manufacturer.~~

The design shall be such that the cables can be readily connected from the front.

When a PENDA does not have a means of measurement incorporated, it shall be possible, by the use of a portable instrument, to readily and safely measure voltages in all phases of incoming units and on both sides of all current breaking and/or switch devices of outgoing units, also the current in one phase of all outgoing units. During this operation all live parts of the PENDA shall be protected sufficiently to retain the required degree of protection in accordance with 8.2. Instructions concerning the procedure to be adopted shall be provided by the manufacturer.