

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Ensembles d'appareillage à basse tension –
Partie 5: Ensembles pour réseaux de distribution publique**

[IEC 61439-5:2023](https://standards.iteh.ai/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023)

<https://standards.iteh.ai/catalog/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 61439-5

Edition 3.0 2023-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Ensembles d'appareillage à basse tension –
Partie 5: Ensembles pour réseaux de distribution publique**

[IEC 61439-5:2023](https://standards.iteh.ai/catalog/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023)

<https://standards.iteh.ai/catalog/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.130.20

ISBN 978-2-8322-6939-8

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	6
3 Terms and definitions	7
4 Symbols and abbreviations.....	8
5 Interface characteristics.....	8
6 Information	8
7 Service conditions	9
8 Constructional requirements	10
9 Performance requirements.....	12
10 Design verification	12
11 Routine verification.....	27
Annexes	28
Annex L (informative) Guidance on verification of temperature rise.....	29
Annex AA (normative) Cross-section of conductors.....	30
Annex BB (informative) Items subject to agreement between the assembly manufacturer and the user	32
Annex CC (informative) Design verification	36
Annex DD (informative) List of notes concerning certain countries.....	37
Bibliography.....	38
Figure 101 – Typical distribution network.....	6
Figure 102 – Diagram of test to verify resistance to shock load of a PENDA-O	15
Figure 103 – Diagram of test to verify impact force withstand of a PENDA-O	16
Figure 104 – Diagram of test to verify the resistance to static load.....	17
Figure 105 – Sandbag for test to verify the resistance to shock load	18
Figure 106 – Diagram of test to verify resistance to torsional stress of a PENDA-O	20
Figure 107 – Diagram of test to verify the mechanical strength of doors.....	23
Figure 108 – Striker element for test of resistance to mechanical shock impacts induced by sharp-edged objects.....	24
Figure 109 – Typical test arrangement for mechanical strength of base	25
Table 101 – Values of assumed loading.....	8
Table 102 – Axial load to be applied to the inserts	24
Table AA.1 – Minimum and maximum cross-section of copper and aluminium conductors, suitable for connection (see 8.8).....	30
Table AA.2 – Standard cross-sections of round copper conductors and approximate relationship between mm ² and AWG/kcmil sizes (see 8.8 of IEC 61439-1:2020).....	31
Table BB.1 – Items subject to agreement between the ASSEMBLY manufacturer and the user	32
Table CC.1 – List of design verifications to be performed.....	36

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

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 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. Tests at higher performance level can be applicable with some network parameters.

PENDAs 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 can be carried out other than by the original manufacturer (see 3.10.1 of IEC 61439-1:2020).

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.

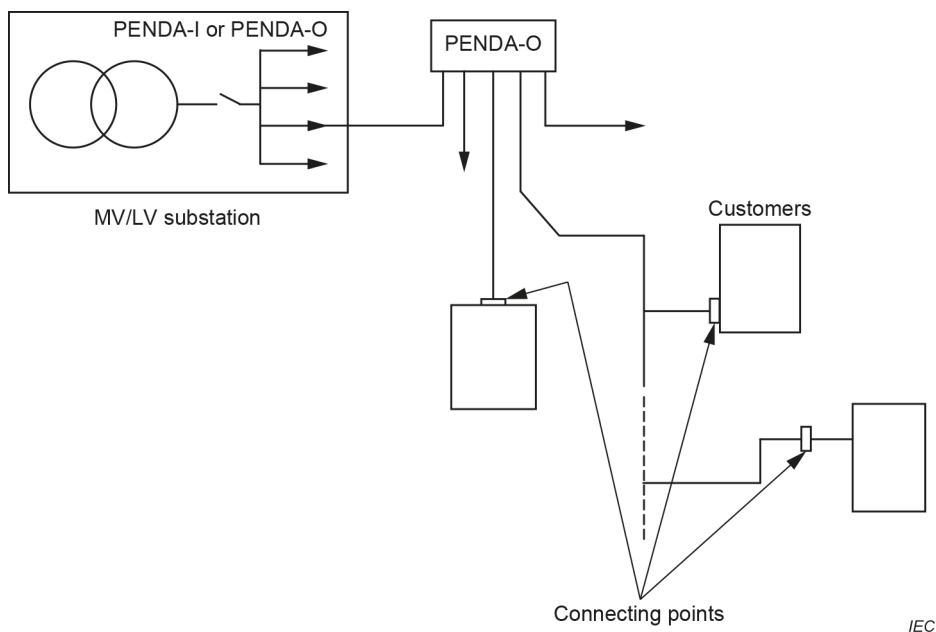


Figure 101 – Typical distribution network

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 61439-1:2020).

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

<https://standards.itec.ai/Document-Preview/IEC-61439-5:2023>
 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 61439-1:2020, *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 can, or 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

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 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

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 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 g):

g) 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 .

7.1.2 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

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 can be directly coupled to a transformer by means of a flange coupling or it 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 locking device shall be provided on outdoor enclosures which prevents access by unauthorized persons. 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 flammability properties in accordance with 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.

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:

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.

8.4.2.1 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 required degree of protection (IP code) is maintained for all parts of the assembly.

8.4.3.1 Installation conditions

Additional paragraph:

[IEC 61439-5:2023](https://standards.iteh.ai/catalog/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023)

<https://standards.iteh.ai/catalog/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023>

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 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:

8.101 Marking as an obstacle to snow clearance

When specified by the user, a PENDA-O that is intended for use in regions where heavy snowfalls occur in accordance with 7.2, shall be 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.

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 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.

If the assembly is intended to be connected to a live reserve power, for example a standby generator, the switchgear connecting device shall be designed so that connection can be made with the live parts having a degree of protection of IPXXB according to IEC 60529.

9 Performance requirements

This clause of IEC 61439-1:2020 applies.

<https://standards.iteh.ai/catalog/standards/iec/8a2da473-8478-4601-8679-f8d214af7c4e/iec-61439-5-2023>

10 Design verification

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

10.1 General

Replace 6th, 7th, and 8th paragraph with:

Design verification shall only be achieved by the application of tests in accordance with Clause 10. The alternatives methods of verification by assessment or comparison with a reference design shall not be used (see Table CC.1).

It is not necessary to test every arrangement produced. Tests carried out on a representative sample of the most onerous PENDA are deemed to verify the performance of similar and less onerous assemblies of the same general construction and rating. Examples of tests carried out on most onerous representative sample include:

- 1) A temperature rise test carried out on 800 A PENDA with 5 outgoing circuits is deemed to apply to an 800 A PENDA of the same construction (same general enclosure, same design of busbars and same incoming unit(s)) with 8 outgoing circuits of the same design.
- 2) Mechanical strength tests carried out on the smallest and largest enclosure in a series are deemed to apply to all other enclosures in the series, when they have the same number of doors and when they are of the same general construction.