



SLOVENSKI STANDARD SIST EN 50089:2023

01-januar-2023

Nadomešča:

SIST EN 50089:1995

SIST EN 50089:2015

Visokonapetostne stikalne in krmilne naprave - Tlačno izolirane predelne stene za kovinska ohišja, napolnjena s plinom

High-Voltage switchgear and controlgear - Insulating pressurised partitions for gas filled metal enclosures

Hochspannungs-Schaltgeräte und -Schaltanlagen – Isolierende, druckbeaufschlagte Zwischenwände für gasgefüllte metallgekapselte Anlagen

Appareillage à haute tension - Cloisons isolées sous pression pour enveloppes métalliques sous pression de gaz

Ta slovenski standard je istoveten z: EN 50089:2022

ICS:

29.130.10	Visokonapetostne stikalne in krmilne naprave	High voltage switchgear and controlgear
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SIST EN 50089:2023

en

EUROPEAN STANDARD

EN 50089

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2022

ICS 29.130.10

Supersedes EN 50089:1992; EN 50089:1992/A1:1994

English Version

High-Voltage switchgear and controlgear - Insulating pressurised partitions for gas filled metal enclosures

Appareillage à haute tension - Cloisons isolées sous pression pour enveloppes métalliques sous pression de gaz

Hochspannungs-Schaltgeräte und -Schaltanlagen - Isolierende, druckbeaufschlagte Zwischenwände für gasgefüllte metallgekapselte Anlagen

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 50089:2022) has been prepared by CLC/TC 17AC “High-voltage switchgear and controlgear”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-09-05
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2025-09-05

This document supersedes EN 50089:1992 and all of its amendments and corrigenda (if any).

EN 50089:2022 includes the following significant technical changes with respect to EN 50089:1992:

- Title made more general;
- Modification of scope of voltage, pressure level and gas mixtures;
- Addition of more specific terms and definitions (e.g. partition)
- Material not limited only to cast resin;
- Mechanical properties;
- Possibilities of reduction of test pressures.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Introduction

This document has been revised by CENELEC Technical Committee 17AC “High-voltage switchgear and controlgear”. It supplements the relevant product standards on gas-insulated switchgear and controlgear providing specific requirements for partitions based on insulating material being part of pressurized high-voltage switchgear and controlgear.

In this respect, this document, together with other EN and IEC documents, constitutes the exclusion of HV switchgear from the scope of the Directive 2014/68/EU (superseding 97/23/EC) concerning pressure equipment. Article 1, 2. (l) excludes “enclosures for high-voltage electrical equipment such as switchgear, controlgear, transformers, and rotating machines” from the scope of the Directive.

This document covers the requirements for the design, construction, testing, inspection and certification of partitions based on insulating material for gas-filled enclosures for use specifically in high-voltage switchgear and controlgear, or for associated gas-filled equipment.

Special consideration is given to these partitions for the following reasons.

- a) For electrical reasons the partitions need to be manufactured from an insulating material.
- b) The partitions usually form the containment of electrical equipment, thus their shape is determined by electrical rather than mechanical requirements. The mechanical requirements should be met in any case.
- c) The enclosures in which the partitions are integrated are installed in restricted access areas and the equipment is operated by instructed, authorized persons only.
- d) The insulating material is generally qualified against decomposition products of SF₆ and other insulating gases. The thorough drying of gas-filling medium is fundamental for the satisfactory operation of the electrical equipment. The gas is periodically checked. For this reason, no corrosion allowance is required on the wall thickness of these partitions.
- e) The enclosures are subjected to only small (in the relation to design pressure) fluctuations of pressure as the gas-filling density will be maintained within close limits to ensure satisfactory insulating and arc-quenching properties. Therefore, the partitions are not liable to fatigue due to pressure cycling.

Due to the foregoing reasons and to ensure maximum service continuity as well as to reduce the risk of moisture and dust entering the enclosures which could endanger safe electrical operation of the switchgear, no pressure tests should be carried out after installation and before placing in service and no periodic inspection of the enclosure interiors or pressure tests should be carried out after the equipment is placed in service.

This document should be a base for a mutual agreement between a manufacturer of electrical equipment and producer of partitions but not limited to it. Additional delivery and test instructions may be agreed between the parties if necessary.

1 Scope

This document applies to pressurized partitions used in indoor and outdoor installations of high-voltage AC and DC switchgear and controlgear with rated voltages (U_r) above 1 kV AC / 1,5 kV DC and with design pressure higher than 300 kPa, where the gas is used principally for its dielectric and/or arc-quenching properties.

The partitions comprise pressurized barriers in electrical equipment not necessarily limited to the following examples:

- circuit-breakers;
- switch-disconnectors;
- disconnectors;
- earthing switches;
- current transformers;
- voltage transformers;
- surge arresters;
- busbars and connections;
- cable connections/terminations;
- cable bushings.

Partitions which are only pressurized from one side are also covered.

1 kV AC / 1,5 kV DC means it is valid for the apparatus applied and where the partitions are installed; however, the application of voltages below 1 kV AC / 1,5 kV DC as in, for example, current and voltage transformers are not excluded.

This document does not apply to high voltage bushings (see EN 60137, EN 61462 and EN 62155).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10204, *Metallic products — Types of inspection documents*

EN 62271-1, *High-voltage switchgear and controlgear — Part 1: Common specifications for alternating current switchgear and controlgear*

EN IEC 62271-200:2021, *High-voltage switchgear and controlgear — Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (IEC 62271-200:2021)*

EN IEC 62271-203:2022, *High-voltage switchgear and controlgear — Part 203: AC gas-insulated metal-enclosed switchgear for rated voltages above 52 kV (IEC 62271-203:2022)*

EN ISO 527 (series), *Plastics — Determination of tensile properties (ISO 527 series)*

EN 50089:2022 (E)

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

gas-insulated metal-enclosed switchgear

GIS

metal-enclosed switchgear in which the insulation is obtained, at least partly, by an insulating gas or gas mixture other than air at atmospheric pressure

Note 1 to entry: This term generally applies to high-voltage switchgear and controlgear.

Note 2 to entry: Three-phase enclosed gas-insulated switchgear applies to switchgear with the three phases enclosed in a common enclosure.

Note 3 to entry: Single-phase enclosed gas-insulated switchgear applies to switchgear with each phase enclosed in single independent enclosure.

[SOURCE: EN IEC 62271-203:2022, 3.102]

3.2

partition

gas tight support insulator of gas-insulated metal-enclosed switchgear separating two adjacent compartments

Note 1 to entry: Or an insulator in the gas compartment which is pressurized on one side and atmospheric pressure exists at all times on the other side (e.g. enclosure of opening with cable bushings, cable terminations, viewports, earthing insulations, instrument transformers terminals, etc.).

[SOURCE: EN IEC 62271-203:2022, 3.109]

3.3

enclosure

compartment as part of GIS retaining the insulating gas under the prescribed conditions necessary to maintain safely the rated insulation level, protecting the equipment against external influences and providing a high degree of protection to personnel

3.4

manufacturer

organization that is responsible for the design of the partition and the production of the GIS

Note 1 to entry: In this document, this is mostly the GIS manufacturer or the cable manufacturer or cable accessory supplier.

3.5

producer

organization that produces the partition

3.6

design pressure of partitions

relative pressure across the partition

Note 1 to entry: It is at least equal to the maximum differential pressure across the partition during maintenance activities.

Note 2 to entry: The transient pressure occurring during and after a breaking operation (e.g. circuit-breaker) is not to be considered in the determination of the design pressure.

Note 3 to entry: It is at least equal to the maximum pressure in the enclosure at the highest temperature that the gas used for insulation can reach under specified maximum service conditions.

[SOURCE: EN IEC 62271-203:2022, 3.115, modified — term and definition changed slightly and Note 3 to entry added]

3.7

design stress

maximum permissible stress on the partition imposed by conditions of operation, environment or test that determine the (material) characteristics of a partition

3.8

routine test pressure of enclosures and partitions

relative pressure to which all enclosures and partitions are subjected after manufacturing

[SOURCE: EN IEC 62271-203:2022, 3.117]

3.9

type test pressure of enclosures and partitions

relative pressure to which all enclosures and partitions are subjected for type test

[SOURCE: EN IEC 62271-203:2022, 3.118]

3.10

defect

inner and surface imperfections of partitions after production

3.10.1

inclusion

extraneous material entrapped in the raw material or entrapped during the manufacture of the product

3.10.2

crack

cracks in materials caused by stresses in the material or the manufacturing process

3.10.3

shrinkage cavity

cavity created during the curing of parts

3.11

thermal treatment

heating, holding at elevated temperature and cooling of the material in such a way as to obtain desired internal structure or mechanical properties

Note 1 to entry: The term “heat treatment” is used for the same concept as a synonym.

EN 50089:2022 (E)**3.12****batch**

- each separate mix of raw material components or
- where the mix is continuous charging, changing of the production lot of the critical component of the mix or
- each week production whichever is the lower

3.13**tensile strength**

ratio of maximum load before rupture in a tensile test to original cross-sectional area

3.14**glass transition temperature** **T_G**

characteristic value of the temperature range over which the glass transition takes place

Note 1 to entry: The assigned glass transition temperature (T_G) may vary, depending on the specific property and on the method and conditions selected to measure it.

[SOURCE: ISO 11357-2:2020]

4 Quality assurance

The manufacturer is responsible for achieving and maintaining a consistent and adequate quality of the switchgear. The producer is responsible for achieving and maintaining a consistent and adequate quality of the partition.

Sufficient examinations including the requirement specified under Clauses 8 and 9 shall be made by the producer to ensure that the materials, production and testing comply in all aspects with the requirements of this document.

Third party inspections shall not absolve the switchgear manufacturer from their responsibility to exercise such quality assurance procedures as to ensure that the requirements and intent of this document are satisfied.

5 Normal and special service conditions

The normal and special service conditions of EN 62271-1 are applicable.

6 Materials and their selection

This document applies to partitions made of polymers, polymer-based composites or ceramics, any thermoplastic (e.g. polyethylene terephthalate - PET) or thermosetting (e.g. epoxy resin) polymers with a suitable filler provided the requirements of this document are met.

Material characterizations and qualifications shall be provided per each kind of material used to produce partitions (e.g. general technical data sheet).

The main properties of the material types shall regularly be tested by the producer according to material specification. The main properties to be measured should be agreed between producer and manufacturer.

The partitions shall be traceable to a given batch of material and manufacturing process either by serial number, batch number or date (refer to 8.4) by the producer.

The use and any change of material shall be explained and agreed between the partition producer and the manufacturer.