SLOVENSKI STANDARD
SIST EN 50052:2017

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Ohišja iz lite aluminijeve zlitine za plinske visokonapetostne stikalne in krmilne naprave

Cast aluminium alloy enclosures for gas-filled high-voltage switchgear and controlgear

Kapselungen aus Leichtmetallguss für gasgefüllte Hochspannungs-Schaltgeräte und -Schaltanlagen

Enveloppes en alliage d'aluminium coulé pour l'appareillage à haute tension sous pression de gaz

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English Version

High-voltage switchgear and controlgear - Gas-filled cast aluminium alloy enclosures

Enveloppes moulées en alliage d'aluminium pour les appareillages à haute tension sous pression de gaz

Hochspannungs-Schaltgeräte und -Schaltanlagen - Gasgefüllte Kapselungen aus Leichtmetallguss

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CENELEC

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

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European foreword

This document (EN 50052:2016) 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)	2017-09-12
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2019-09-12

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This document supersedes EN 50052:1986.

This European Standard supplements the relevant product standards on gas-insulated switchgear and controlgear in that it provides specific requirements for pressurized high-voltage switchgear and controlgear.

This European Standard has been written to get a European specification for the design, construction, testing, inspection and certification of pressurized enclosures used in high-voltage switchgear and controlgear.

In this respect, this European Standard 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 European Standard deals with gas-insulated switchgear enclosures of cast aluminium alloy. For different enclosure materials other European Standards are available.

Introduction

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

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

(a) The enclosures usually form the containment of electrical equipment, thus their shape is determined by electrical rather than mechanical requirements.

(b) The enclosures are installed in restricted access areas and the equipment is operated by instructed, authorized persons only.

(c) As the thorough drying of the inert, non-corrosive gas medium is fundamental to the satisfactory operation of the electrical equipment, the gas is periodically checked. For this reason, no internal corrosion allowance is required on the wall thickness of these enclosures.

(d) The enclosures are subjected to only small fluctuations of pressure as the gas-filling density shall be maintained within close limits to ensure satisfactory insulating and arc-quenching properties. Therefore the enclosures are not liable to fatigue due to pressure cycling.

(e) The operating pressure is relatively low.

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 may 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.

1 General

1.1 Scope

This European Standard applies to cast aluminium alloy enclosures pressurized with dry air, inert gases, for example sulphur hexafluoride or nitrogen or a mixture of such gases, used in indoor or outdoor installations of high-voltage switchgear and controlgear above 1 kV, where the gas is used principally for its dielectric and/or arc-quenching properties with rated voltages

- above 1 kV and up to and including 52 kV and with gas-filled enclosures with design pressure higher than 300 kPa relative pressure (gauge);
- and with rated voltage above 52 kV.

The enclosures comprise parts of electrical equipment not necessarily limited to the following examples:

- Circuit-breakers
- Switch-disconnectors
- Disconnectors
- Earthing switches
- Current transformers
- Voltage transformers
- Surge arrestors
- Busbars and connections
- etc.

The scope also covers enclosures of pressurized components such as the centre chamber of live tank switchgear, gas-insulated current transformers, etc.

1.2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 12258-1:2012, *Aluminium and aluminium alloys — Terms and definitions — Part 1: General terms*

EN 50064, *Wrought aluminium and aluminium alloy enclosures for gas-filled high-voltage switchgear and controlgear*

EN 62271-1:2008, *High-voltage switchgear and controlgear — Part 1 Common specifications (IEC 62271-1:2007)*

EN 62271-203:2012, *High-voltage switchgear and controlgear — Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV (IEC 62271-203:2011)*

EN ISO 898 (series), *Mechanical properties of fasteners made of carbon steel and alloy steel*

EN ISO 6520-1:2007, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding (ISO 6520-1:2007)*

EN ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 15614-4, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 4: Finishing welding of aluminium castings (ISO 15614-4)*

1.3 Quality assurance

It is the intention of this standard that the switchgear manufacturer shall be responsible for achieving and maintaining a consistent and adequate quality of the product.

Sufficient examinations shall be made by the founder to ensure that the materials, production and testing comply in all respects with the requirements of this standard.

Inspection by the user inspectors shall not absolve the manufacturer or the founder from their responsibility to exercise such quality assurance procedures as to ensure that the requirements of this standard are satisfied.

2 Normal and special service conditions

Clause 2 of EN 62271-1:2008 is applicable.

3 Terms and definitions

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

3.1
enclosure
part of gas-insulated metal-enclosed switchgear 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

3.2
manufacturer
organisation that is responsible for the design of the enclosure and the production of the gas-insulated switchgear. In this standard this is the switchgear manufacturer

3.3
founder
organisation that produces the raw casting of the enclosure

3.4
design pressure
pressure, expressed in relative terms (gauge), used to determine the thickness of the enclosure

Note 1 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.

3.5
design temperature (of an enclosure)
maximum temperature that the enclosures can reach under specified maximum service conditions

[SOURCE: 3.112, EN 62271-203:2012]

Note 1 to entry: This is generally the upper limit of ambient air temperature increased by the temperature rise due to the flow of rated normal current.

Note 2 to entry: Solar radiation should be taken into account when it has a significant effect on the temperature of the gas and on the mechanical properties of materials. Similarly, the effects of low temperatures on the properties of materials should be considered.

3.6
design stress
maximum permissible stress on the enclosure imposed by conditions of operation, environment or test that determine the (material) characteristics of an enclosure

3.7
normal load
load whose occurrence and level can be planned or predicted

3.8
exceptional load
load whose probability of occurrence during the lifetime of product is very small or accidental

3.9
casting
product at or near finished shape, formed by solidification of the metal in a mould or a die

[SOURCE: EN 12258-1:2012, 2.5.1]

3.10
melt
quantity of molten metal that has simultaneously undergone the same preparatory treatment in the furnace before the casting operation

[SOURCE: EN 12258-1:2012, 4.1.3]

3.11
alloy
substance having metallic properties and composed of two or more elements so combined that they cannot readily be separated by physical means

[SOURCE: EN 12258-1:2012, 2.2.1]

3.12
casting defect
imperfections in castings after solidification

3.12.1
cold shut
linear discontinuity in a cast surface caused by freezing of the melt meniscus in contact with the mould and the liquid metal flowing over the solidified metal

[SOURCE: EN 12258-1:2012, 5.2.1]

3.12.2
cold crack
crack in cast metal initiated by mechanical stresses at temperatures significantly below the solidus temperature

[SOURCE: EN 12258-1:2012, 5.2.9]

3.12.3
hot crack (hot tear)
crack formed in a cast metal or in a welding because of internal stress developed upon cooling at the solidus temperature or slightly above

[SOURCE: EN 12258-1:2012, 5.2.8]

3.12.4
inclusion
extraneous material accidentally entrapped into the liquid metal during melting or melt treatment or entrapped into the metal surface during hot or cold working

[SOURCE: EN 12258-1:2012, 5.5.7]

3.12.5
blister
raised spot whose inside is hollow, that forms on the surface of products and is caused by the penetration of a gas into a subsurface zone typically during thermal treatment

[SOURCE: EN 12258-1:2012, 5.5.10]

Note 1 to entry: A void resulting from blister that has ruptured is often termed “blow hole”.

3.13
weld defect
imperfections in metallic fusion welds

3.13.1
lack of fusion
lack of union between the weld metal and the parent material or between the successive layers of weld metal

[SOURCE: EN ISO 6520-1:2007, Reference No. 401]

3.13.2
overlap
excessive weld metal covering the parent material surface but not fused to it

[SOURCE: EN ISO 6520-1:2007, Reference No. 506]

3.13.3
undercut
irregular groove at a toe of a run in the parent material or in previously deposited weld metal

[SOURCE: EN ISO 6520-1:2007, Reference No. 501]

3.14
thermal treatment
heating, holding at elevated temperature and cooling of the solid metal in such a way as to obtain desired metallurgical structure or properties

[SOURCE: EN 12258-1:2012, 3.6.1]

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

3.15
ductility
ability of a material to deform plastically before fracturing

[SOURCE: EN 12258-1:2012, 4.3.15]

3.16
fatigue
tendency for a metal to break under conditions of repeated cyclic stressing considerably below the tensile strength

[SOURCE: EN 12258-1:2012, 4.3.23]