IEC 62271-214

Edition 1.0 2019-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

High-voltage switchgear and controlgear – Part 214: Internal arc classification for metal-enclosed pole-mounted switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

Appareillage à haute tension – Partie 214: Classification arc interne des appareillages sous enveloppe métallique de tensions assignées supérieures à 1 kV et inférieures ou égales à 52 kV montés sur poteau

IEC 62271-214:2019-06(en-fr)

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 214: Internal arc classification for metal-enclosed pole-mounted switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

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International Standard IEC 62271-214 has been prepared by subcommittee 17C Assemblies, of IEC technical committee 17: Switchgear and controlgear.

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

FDIS	Report on voting
17C/706/FDIS	17C/710/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This standard shall be read in conjunction with IEC 62271-1, second edition, published in 2017, to which it refers and which is applicable unless otherwise specified in this standard. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC 62271-1. Amendments to these clauses and subclauses are given under the same references whilst additional subclauses are numbered from 101. Any clause with the term “Not Applicable” relates to the clause not being relevant to IEC 62271-214 and does not infer the clause is or is not relevant for its applicable switchgear standard.

A list of all parts of the IEC 62271 series, published under the general title *High-voltage switchgear and controlgear*, 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 "http://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- withdrawn,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.

INTRODUCTION

IEC 62271-214 has been developed due to the requirement to remove IAC Type C designated pole mounted switchgear from IEC 62271-200. Only enclosed terminal equipment is to be considered within IEC 62271-200. For this reason, IEC 62271-214 is to be considered independent of IEC 62271-200, however it is still related to other product standards of the IEC 62271 series.

Only open terminal pole mounted switchgear has been considered within this document.

This equipment relates to operation in three-phase, two-phase and single-phase systems.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 214: Internal arc classification for metal-enclosed pole-mounted switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

1 Scope

This part of IEC 62271 specifies requirements for internal arc classification of metal-enclosed pole-mounted switchgear installations used for alternating current with rated voltages above 1 kV and up to and including 52 kV with service frequencies up to and including 60 Hz. This document is applicable to three-phase, two-phase and single phase equipment. Enclosures may include fixed and removable components and may be filled with fluid (liquid or gas) to provide insulation.

NOTE For the use of this document high-voltage (IEC 60050-601:1985, 601-01-27) is the rated voltage above 1 000 V. However, medium voltage (IEC 60050-601:1985, 601-01-28) is commonly used for distribution systems with voltages above 1 kV and generally applied up to and including 52 kV; refer to [1] of the Bibliography.

This document does not preclude that other equipment may be included in the same enclosure. In such a case, any possible influence of that equipment on the switchgear and controlgear is to be taken into account.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60050-151:2001, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

IEC 60050-441:1984, *International Electrotechnical Vocabulary – Part 441: Switchgear, controlgear and fuses*

IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-151, IEC 60050-441 and IEC 62271-1 as well as the following apply.

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

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

NOTE Additional definitions are classified so as to be aligned with the classification system used in IEC 60050-441.

3.1 General terms and definitions

3.1.101
metal-enclosed switchgear and controlgear
switchgear and controlgear assemblies with an external metal enclosure intended to be earthed and completely assembled, except for external connections

[SOURCE: IEC 60050-441:1984, 441-12-04, modified – NOTE has been deleted]

3.1.102
functional unit
part of pole-mounted switchgear and controlgear comprising all the components of the main circuits and auxiliary circuits that contribute to the fulfilment of a single function

Note 1 to entry: Functional units are distinguished according to the function for which they are intended, e.g. incoming unit, outgoing unit, etc.

[SOURCE: IEC 60050-441:1984, 441-13-04, modified – references to the supply and feed sides in the note has been deleted]

3.1.103
enclosure
part of an assembly providing a specified degree of protection of equipment against external influences and a specified degree of protection against approach to or contact with live parts and against contact with moving parts

[SOURCE: IEC 60050-441:1984, 441-13-01]

3.1.104
high-voltage compartment
compartment of switchgear and controlgear containing high-voltage conducting parts, enclosed except for openings necessary for interconnection, control or ventilation, where one segment of the compartment can be part of the outer earthed metallic enclosure

3.1.105
component
essential part of the high-voltage or earthing circuits of pole-mounted switchgear and controlgear which serves a specific function

EXAMPLE Circuit-breaker, disconnector, switch, fuse, instrument transformer, bushing, busbar.

3.1.106
main circuit
all the high-voltage conductive parts of pole-mounted switchgear and controlgear included in a circuit which is intended to carry the rated continuous current

[SOURCE: IEC 60050-441:1984, 441-13-02, modified – “high voltage” has been added, “assembly” has been substituted by “pole mounted switchgear and controlgear” and “transmit electrical energy” has been substituted by “carry the rated continuous current”.]

3.1.107
earthing circuit
conductors, connections, and the conducting parts of earthing devices intended to connect the high-voltage conductive parts to the earthing system of the installation

Note 1 to entry: Parts of metallic enclosures connected to the earthing system can be part of the earthing circuit.

3.1.108
pressure relief device
device incorporated as part of an enclosure or compartment intended to operate to prevent excessive pressure in the enclosure or compartment

3.1.109
fluid-filled compartment
high-voltage compartment of pole-mounted switchgear and controlgear filled with a fluid, either gas, other than ambient air, or liquid, for insulation purposes

3.1.110
pole
vertical single member support in wood, concrete, steel or other material, with one end buried in the ground, either directly or by means of a foundation

Note 1 to entry: The term pole as defined here is not to be mixed up with the use of the same term as synonymous for phase as used in other standards.

[SOURCE: IEC 60050-466:1990, 466-07-01, modified – Note 1 to entry has been added]

3.1.111
pole-mounted switchgear and controlgear
switchgear and controlgear, typically connected to overhead lines, installed on one or more poles or equivalent structures at a defined height, with restricted accessibility by installation out of reach

3.1.112
internal arc classified switchgear and controlgear
IAC
metal-enclosed switchgear and controlgear for which prescribed criteria, for protection of authorized persons and the general public, are met in the event of internal arc as demonstrated by type tests

Note 1 to entry: The internal arc classification is described by the characteristics given from 3.1.1013 to 3.1.1016.

[SOURCE: IEC 62271-200:2011, 3.132, modified – “authorized” and “and general public” have been added]

3.1.113
arc fault current
three-phase and where applicable the single phase-to-earth RMS value of the internal arc fault current for which the switchgear and controlgear is designed to protect persons in the event of an internal arc

[SOURCE: IEC 62271-200:2011, 3.132.3]

3.1.114
arc fault duration
duration of the internal arc fault current for which the switchgear and controlgear is designed to protect persons in the event of an internal arc

[SOURCE: IEC 62271-200:2011, 3.132.4]

3.1.115
approach distance
distance between the test object and indicators arranged in an IAC test

3.1.116
arc mitigation device
device dedicated to reacting to internal arc fault conditions to decrease the arc energy

[SOURCE: CIGRE BROCHURE 686:2017, *Mitigating the effects of arc in M.V. Switchgear*][17][1]

4 Normal and special service conditions

4.1 General

Unless otherwise specified in this document, operation under normal and special service conditions is considered to be covered by the relevant IEC standard.

5 Ratings

5.1 General

The ratings with respect to the arc fault classification of pole-mounted switchgear and controlgear are the following:

a) rated voltage (U_r);
b) rated frequency (f_r);
c) ratings of the internal arc classifications (IAC);

5.2 Rated voltage (U_r)

5.2.1 General

The rated voltage is equal to the maximum system voltage for which the equipment is designed. It indicates the maximum value of the “highest system voltage” of networks for which the equipment may be used (refer to Clause 9 of IEC 60038:2009).

NOTE It is possible that components forming part of pole-mounted switchgear and controlgear have differing values of rated voltage in accordance with their relevant standards.

5.3 Rated insulation level (U_d, U_p, U_s)

Not applicable.

5.4 Rated frequency (f_r)

The standard values of the rated frequency are 16,7 Hz, 25 Hz, 50 Hz and 60 Hz.

5.101 Ratings of the internal arc classification (IAC)

5.101.1 General

An IAC classified pole-mounted switchgear and controlgear shall have the following ratings: rated approach distance, arc fault currents and arc fault durations.

5.101.2 Rated approach distance (D_{AP})

The rated approach distance shall be stated by the manufacturer (refer to Figure 2).

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1 Numbers in square brackets refer to the bibliography.

5.101.3 Rated arc fault currents (I_A, I_{Ae})

The standard value of rated arc fault currents should be selected from the R 10 series specified in IEC 60059.

Two ratings of the arc fault currents are recognised:

a) three-phase and phase-to-phase arc fault current (I_A), when applicable;

b) single phase-to earth arc fault current (I_{Ae}), when applicable.

When only a three-phase rating is specified, the single-phase rating is by default 87 % of the three-phase rating, and need not be specified.

NOTE 1 The rationale for this 87 % is the arc fault test with 2-phase ignition; refer to 7.101.7.2.

The manufacturer shall specify the compartments to which the single phase-to earth arc fault current rating applies. Such value is assigned to switchgear and controlgear where its construction will prevent the arc from becoming multiphase, as demonstrated during the internal arc test.

When IAC testing on single phase switchgear and controlgear or single-phase high voltage compartments where only a single phase supply circuit has been applied only an I_{Ae} rating shall be assigned. (refer to 7.101.7.2).

NOTE 2 Information about the relationship between type of neutral earthing and the single phase-to-earth arc fault current is provided in 9.101.6.

5.101.4 Rated arc fault duration (t_A, t_{Ae})

Standard recommended values for the arc fault duration (t_A, t_{Ae}) are 0,1 s, 0,5 s and 1 s.

NOTE It is in general not possible to calculate the permissible arc duration for a current which differs from that used in the test.

6 Design and construction

6.11 Nameplate

6.11.1 General

Pole-mounted switchgear and controlgear, with a rated internal arc classification shall include in the nameplate the additional IAC information in accordance with Table 1.

Table 1 – Nameplate information

	Abbreviation	Unit	**	Condition: Marking only required if
(1)	(2)	(3)	(4)	(5)
Internal arc classification	IAC		X	
Rated approach distance	D_{AP}	m	X	
Arc fault current and duration	I_A, t_A	kA, s	Y	three-phase test or phase-to-phase test are applicable
Single phase-to-earth arc fault current and duration	I_{Ae}, t_{Ae}	kA, s	Y	a single-phase test is applicable or I_{Ae} differs from 87 % of I_A
Fitted with arc mitigation device			Y	arc mitigation device fitted and not disabled during testing
(**) X = the marking of these values is mandatory where internal arc classification is assigned; Y = conditions for marking of these values are given in column (5).				
NOTE 1 If there is an abbreviation in column (2) it can be used instead of the terms in column (1).				

6.101 Internal arc fault

Pole-mounted switchgear and controlgear, in principle, are designed and manufactured, to prevent the occurrence of internal arc faults.

However, where internal arc classification is assigned, the switchgear and controlgear shall be designed to give a defined level of protection of persons in the event of an internal arc, when the switchgear and controlgear is in normal service condition.

If an internal arc classification is assigned by the manufacturer and verified by type tests according to 7.101, the pole-mounted switchgear and controlgear shall be designated as follows:

– Designation: IAC (Internal Arc Classified)
– Rated three-phase arc fault values (where applicable): current [kA] and duration [s] and/or
– Rated single-phase arc fault values (where applicable): current [kA] and duration [s]
– If the unit is fitted with a device limiting the duration of the arc that cannot be disabled, then the IAC designation shall indicate that the switchgear and controlgear is: “Fitted with arc mitigation device”

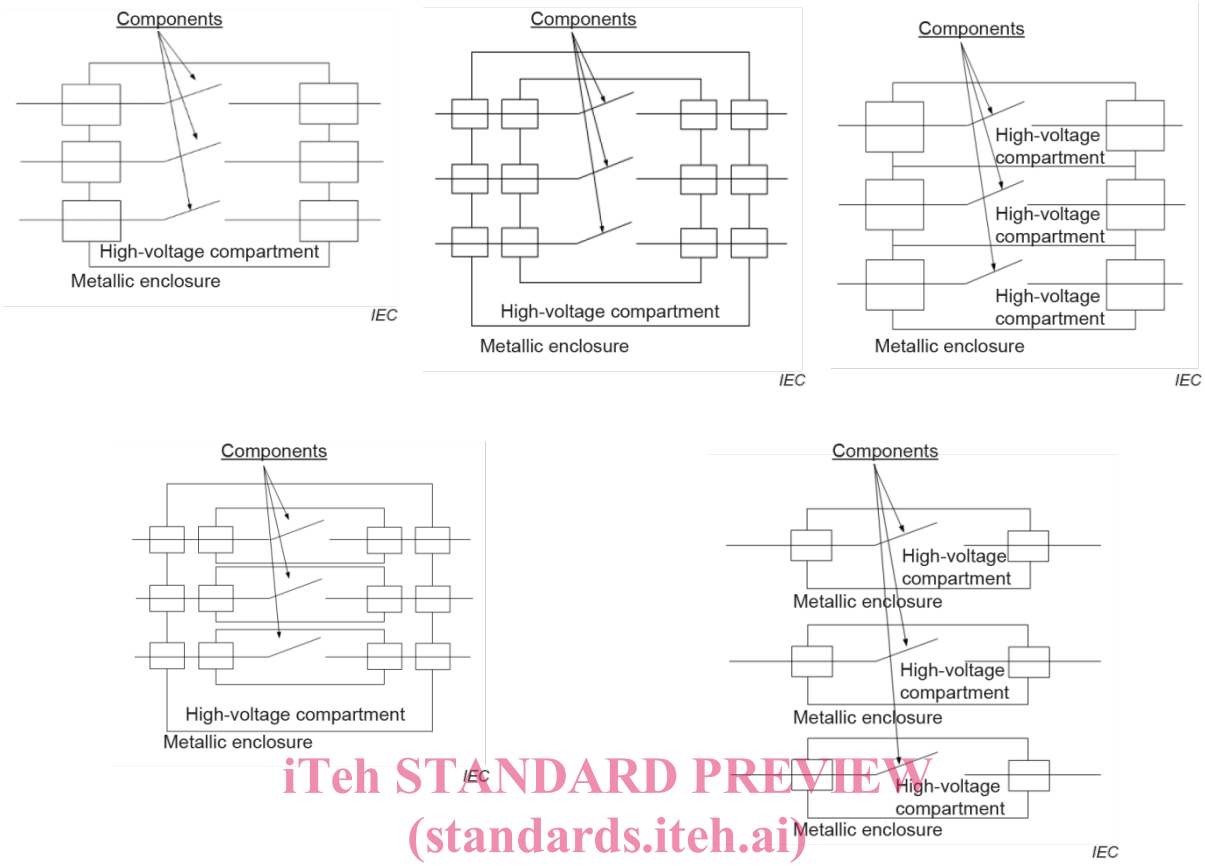
This designation shall be included in the nameplate (refer to 6.11)

Some examples for internal arc classification are given in 7.101.7.2.5.

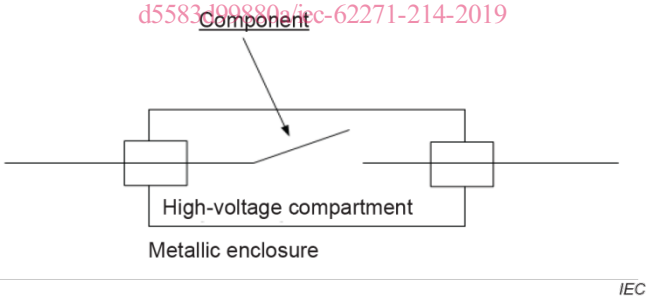
6.102 Enclosure

The complete enclosure should be capable of withstanding the mechanical, electrical, thermal and environmental stresses likely to be encountered in normal service conditions.

Figure 1 shows examples of different arrangements of components in high voltage compartment(s) within an enclosure.



a) three-phase



b) single-phase

Figure 1 – Examples of enclosures and compartment(s) in different arrangements

7 Type tests

7.1 General

7.1.1 Basics

The type test is performed to verify the internal arc ratings and characteristics of pole-mounted switchgear.

7.1.2 Information for identification of test object

The manufacturer shall submit to the testing laboratory, drawings and other data containing sufficient information to unambiguously identify by type the essential details and parts of the switchgear presented for test. A summary list of the drawings and data schedules shall be