

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**High-voltage switchgear and controlgear –  
Part 109: Alternating-current series capacitor by-pass switches**

**Appareillage à haute tension –  
Partie 109: Interrupteurs de contournement pour condensateurs série à courant  
alternatif**

IEC 62271-109:2008

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ELECTROTECHNICAL  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 109: Alternating-current series capacitor  
by-pass switches**

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International Standard IEC 62271-109 has been prepared by subcommittee 17A: High-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This second edition cancels and replaces the first edition, published in 2006, and constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

- By-passing test duty has been split with operations at rated by-pass making current  $I_{BP}$  and operations at capacitor bank discharge current  $I_{DISCHARGE}$ .
- Equivalence regarding applicability of test parameters (current peak and frequency) during by-pass making tests in relation with service conditions have been reviewed and changed accordingly.
- Recovery voltage waveshape during insertion test duty has been recalculated and optimized. An explanatory note on the calculation of the recovery voltage is given in Annex F.

- Withdrawal of the electrical endurance class BP2. Such devices are now covered in informative Annex E
- Addition of Annex D which gives examples of typical by-pass switch ratings.

The text of this standard is based on the following documents:

FDIS	Report on voting
17A/837/FDIS	17A/844/RVD

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

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

A list of all parts of the IEC 62271 series can be found, under the general title *High-voltage switchgear and controlgear*, on the IEC website.

This standard is to be read in conjunction with IEC 62271-100 and IEC 62271-1 (2007), 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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

# HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

## Part 109: Alternating-current series capacitor by-pass switches

### 1 General

#### 1.1 Scope

This part of IEC 62271 is applicable to a.c. series capacitor by-pass switches designed for outdoor installation and for operation at frequencies of 50 Hz and 60 Hz on systems having voltages above 52 kV.

It is only applicable to by-pass switches for use in three-phase systems.

This standard is also applicable to the operating devices of by-pass switches and to their auxiliary equipment.

#### 1.2 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 60050-436:1990, *International Electrotechnical Vocabulary – Chapter 436: Power capacitors*

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

IEC 60050-604:1987, *International Electrotechnical Vocabulary – Chapter 604: Generation, transmission and distribution of electricity – Operation*

IEC 60060 (all parts), *High-voltage test techniques*

IEC 60143-1:2004, *Series capacitors for power systems – Part 1: General*

IEC 60143-2:1994, *Series capacitors for power systems – Part 2: Protective equipment for series capacitor banks*

IEC 60296, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60376, *Specification of technical grade sulphur hexafluoride (SF<sub>6</sub>) for use in electrical equipment*

IEC 60480, *Guidelines for the checking and treatment of sulphur hexafluoride (SF<sub>6</sub>) taken from electrical equipment and specification for its re-use*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 62271-1:2007, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

IEC 62271-101, *High-voltage switchgear and controlgear – Part 101: Synthetic testing*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-303, *High-voltage switchgear and controlgear – Part 303: Use and handling of sulphur hexafluoride (SF<sub>6</sub>)*

## 2 Normal and special service conditions

Clause 2 of IEC 62271-1 is applicable.

## 3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60050-151, IEC 60050-436, IEC 60050-441, IEC 60050-604, IEC 60143-1, IEC 60143-2 and IEC 62271-1 apply. Some of them are recalled here for ease of reference.

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

### 3.1 General terms

**3.1.101 switchgear and controlgear**  
[IEV 441-11-01]

**3.1.102 outdoor switchgear and controlgear**  
[IEV 441-11-05]

**3.1.103 short-circuit current**  
[IEV 441-11-07]

**3.1.104 ambient air temperature**  
[IEV 441-11-13]

**3.1.105 temperature rise (of a part of a by-pass switch)**  
difference between the temperature of the part and the ambient air temperature

**3.1.106 overvoltage (in a system)**  
any voltage between one phase and earth or between phases having a peak value or values exceeding the corresponding peak of the highest voltage for equipment

[IEV 604-03-09, modified]

**3.1.107  
unit test**

test made on a by-passing or insertion unit or group of units at the by-pass making current or the insertion current, specified for the test on the complete pole of a by-pass switch and at the appropriate fraction of the applied voltage, or the recovery voltage, specified for the test on the complete pole of the by-pass switch

**3.1.108  
external insulation**

distances in air and the surfaces in contact with open air of solid insulation of the equipment, which are subject to dielectric stresses and to the effects of atmospheric and other external conditions such as pollution, humidity, vermin, etc.

[IEV 604-03-02, modified]

**3.1.109  
internal insulation**

internal solid, liquid or gaseous parts of the insulation of equipment, which are protected from the effects of atmospheric and other external conditions

[IEV 604-03-03]

**3.1.110  
self-restoring insulation**

insulation which completely recovers its insulating properties after a disruptive discharge

[IEV 604-03-04]

**3.1.111  
non-self restoring insulation**

insulation which loses its insulating properties, or does not recover them completely, after a disruptive discharge

[IEV 604-03-05]

**3.1.112  
disruptive discharge**

phenomenon associated with the failure of insulation under electric stress, in which the discharge completely bridges the insulation under test, reducing the voltage between the electrodes to zero or nearly to zero

NOTE 1 This term applies to discharges in solid, liquid and gaseous dielectrics and to combinations of these.

NOTE 2 A disruptive discharge in a solid dielectric produces permanent loss of dielectric strength (non-self-restoring insulation); in a liquid or gaseous dielectric, the loss may be only temporary (self-restoring insulation).

NOTE 3 The term "sparkover" is used when a disruptive discharge occurs in a gaseous or liquid dielectric. The term "flashover" is used when a disruptive discharge occurs over the surface of a solid dielectric in a gaseous or liquid medium. The term "puncture" is used when a disruptive discharge occurs through a solid dielectric.

**3.1.113  
restrike performance**

expected probability of restrike during insertion current test-duty as demonstrated by specified type test

NOTE Specific numeric probabilities cannot be applied throughout a by-pass switch service life.

**3.1.114  
re-ignition (of an a.c. mechanical switching device)**

[IEV 441-17-45]