IEC 62271-109

Edition 3.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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 62271-109:2019-04(en-fr)

IEC Central Office
3, rue de Varembé
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 It also gives information on projects, replaced and withdrawn publications.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.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

IEC 62271-109

Edition 3.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.130.10

ISBN 978-2-8322-6673-1

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 9
1 Scope 11
2 Normative references 11
3 Terms and definitions 12
3.1 General terms and definitions 12
3.2 Assemblies 15
3.3 Parts of assemblies 15
3.4 Switching devices 15
3.5 Parts of by-pass switches 17
3.6 Operational characteristics of by-pass switches 20
3.7 Characteristic quantities 22
3.8 Terms and definitions related to series capacitor banks 30
3.9 Index of definitions 33
4 Normal and special service conditions 37
5 Ratings 37
5.1 General 37
5.2 Rated voltage (U_r) 38
5.2.1 General 38
5.2.2 Range I for rated voltage of 245 kV and below 38
5.2.3 Range II for rated voltage above 245 kV 38
5.3 Rated insulation level (U_p, U_d, U_s) 38
5.3.101 Rated insulation level to earth (U_{pe}, U_{de}, U_{se}) 38
5.3.102 Rated insulation level across the by-pass switch (U_{pp}, U_{dp}, U_{sp}) 38
5.4 Rated frequency (f_r) 39
5.5 Rated continuous current (I_r) 39
5.6 Rated short-time withstand current (I_k) 39
5.7 Rated peak withstand current (I_p) 39
5.8 Rated duration of short-circuit (t_k) 39
5.9 Rated supply voltage of auxiliary and control circuits (U_a) 39
5.10 Rated supply frequency of auxiliary and control circuits 39
5.11 Rated pressures of compressed gas supply for controlled pressure systems 39
5.101 Rated operating sequence 39
5.102 Rated by-pass making current (I_{BP}) 40
5.103 Rated by-pass insertion current (I_{INS}) 41
5.104 Rated reinsertion voltage (U_{INS}) 41
5.105 Number of mechanical operations 41
6 Design and construction 41
6.1 Requirements for liquids in by-pass switches 41
6.2 Requirements for gases in by-pass switches 42
6.3 Earthing of by-pass switches 42
6.4 Auxiliary and control equipment and circuits 42
6.4.1 General 42
6.4.2 Protection against electrical shock 42
6.4.3 Components installed in enclosures 42
6.5 Dependent power operation 43
6.6 Stored energy operation 43

6.7 Independent unlatched operation (independent manual or power operation) 43
6.8 Manually operated actuators 43
6.9 Operation of releases 43
6.9.1 General 43
6.9.2 Shunt closing releases 43
6.9.3 Shunt opening releases 43
6.9.4 Capacitor operation of shunt releases 44
6.9.5 Under-voltage release 44
6.9.101 Multiple releases 44
6.9.102 Operation limits of releases 44
6.9.103 Power consumption of releases 44
6.10 Pressure/level indication 44
6.10.101 Low- and high-pressure interlocking devices 44
6.11 Nameplates 44
6.12 Locking devices 46
6.13 Position indication 46
6.14 Degrees of protection provided by enclosures 46
6.15 Creepage distances for outdoor insulators 46
6.16 Gas and vacuum tightness 46
6.17 Tightness for liquid systems 46
6.18 Fire hazard (flammability) 46
6.19 Electromagnetic compatibility 46
6.20 X-ray emission 46
6.21 Corrosion 46
6.22 Filling levels for insulation, by-passing, insertion and/or operation 46
6.101 Requirements for simultaneity within a pole 46
6.102 General requirement for operation 46
6.103 Pressure limits of fluids for operation 47
6.104 Vent outlets 47
6.105 Time quantities 47
6.106 Static mechanical loads 48
7 Type tests 48
7.1 General 48
7.1.1 Basics 48
7.1.2 Information for identification of test objects 49
7.1.3 Information to be included in type test reports 49
7.1.101 Invalid tests 50
7.1.102 Type tests to repeat for by-pass switches with alternative operating mechanisms 50
7.2 Dielectric tests 50
7.2.1 General 50
7.2.2 Ambient air conditions during tests 50
7.2.3 Wet test procedure 51
7.2.4 Arrangement of the equipment 51
7.2.5 Criteria to pass the test 51
7.2.6 Application of test voltage and test conditions 51
7.2.7 Tests of by-pass switches of U_{re} ≤ 245 kV or U_{rp} ≤ 245 kV 51
7.2.8 Tests of by-pass switches of U_{re} > 245 kV or U_{rp} > 245 kV 52
7.2.9 Artificial pollution tests for outdoor insulators 52

7.2.10 Partial discharge tests 52
7.2.11 Dielectric tests on auxiliary and control circuits 53
7.2.12 Voltage test as condition check 53
7.3 Radio interference voltage (RIV) tests 54
7.4 Resistance measurement 54
7.5 Continuous current tests 55
7.5.1 Conditions of the test object 55
7.5.2 Arrangement of the equipment 55
7.5.3 Test current and duration 55
7.5.4 Temperature measurement during test 56
7.5.5 Resistance of the main circuit 56
7.5.6 Criteria to pass test 56
7.6 Short-time withstand current and peak withstand current tests 56
7.6.1 General 56
7.6.2 Arrangement of the by-pass switch and of the test circuit 56
7.6.3 Test current and duration 56
7.6.4 Condition of the by-pass switch after test 56
7.7 Verification of the protection 56
7.7.1 Verification of the IP coding 56
7.7.2 Verification of the IK coding 56
7.8 Tightness tests 56
7.9 Electromagnetic compatibility tests (EMC) 56
7.9.1 Emission tests 56
7.9.2 Immunity tests on auxiliary and control circuits 57
7.9.3 Additional EMC tests on auxiliary and control circuits 57
7.10 Additional tests on auxiliary and control circuits 57
7.10.1 General 57
7.10.2 Functional tests 57
7.10.3 Verification of the operational characteristics of auxiliary contacts 57
7.10.4 Environmental tests 57
7.10.5 Dielectric test 58
7.11 X-Radiation test for vacuum interrupters 58
7.101 Mechanical and environmental tests 58
7.101.1 Miscellaneous provisions for mechanical and environmental tests 58
7.101.2 Mechanical operation test at ambient air temperature 60
7.101.3 Low and high temperature tests 62
7.101.4 Humidity test 68
7.101.5 Test to prove the operation under severe ice conditions 68
7.102 Miscellaneous provisions for by-pass making and insertion tests 68
7.102.1 General 68
7.102.2 Number of test specimens 69
7.102.3 Arrangement of by-pass switch for tests 69
7.102.4 General considerations concerning testing methods 70
7.102.5 Synthetic tests 73
7.102.6 No-load operations before tests 73
7.102.7 Alternative operating mechanisms 73
7.102.8 Behaviour of by-pass switch during tests 74
7.102.9 Condition of by-pass switch after tests 74

7.103 By-pass making current test-duty and insertion current test-duty, sequence of tests 76
7.103.1 General 76
7.103.2 By-pass making current test-duty 76
7.103.3 Insertion current test-duty 79
7.103.4 Criteria to pass the test duties 88
8 Routine tests 88
8.1 General 88
8.2 Dielectric test on the main circuit 88
8.3 Tests on auxiliary and control circuits 90
8.3.1 Inspection of auxiliary and control circuits, and verification of conformity to circuit diagrams and wiring diagrams 90
8.3.2 Functional tests 90
8.3.3 Verification of protection against electrical shock 90
8.3.4 Dielectric tests 90
8.4 Measurement of the resistance of the main circuit 90
8.5 Tightness test 90
8.5.1 General 90
8.5.2 Controlled pressure systems for gas 90
8.5.3 Closed pressure systems for gas 91
8.5.4 Sealed pressure systems 91
8.5.5 Liquid tightness tests 91
8.6 Design and visual checks 91
8.101 Mechanical operating tests 91
9 Guide to the selection of by-pass switches (informative) 93
10 Information to be given with enquiries, tenders and orders (informative) 93
10.1 General 93
10.2 Information with enquiries and orders 93
10.3 Information with tenders 94
11 Transport, storage, installation, operating instructions and maintenance 96
11.1 General 96
11.2 Conditions during transport, storage and installation 96
11.3 Installation 96
11.4 Operating instruction 96
11.5 Maintenance 96
11.101 Guide for commissioning tests 96
11.101.1 General 96
11.101.2 Commissioning checks and test programme 97
11.101.3 Resistors and capacitors (if applicable) 102
12 Safety 102
12.1 General 102
12.2 Precautions by manufacturers 103
12.3 Precautions by users 103
13 Influence of the product on environment 103
Annex A (normative) Tolerances on test quantities during type tests 104
Annex B (normative) Records and reports of type tests 108
B.1 Information and results to be recorded 108
B.2 Information to be included in type test reports 108

B.2.1 General 108
B.2.2 Apparatus tested 108
B.2.3 Rated characteristics of by-pass switch, including its operating devices and auxiliary equipment 108
B.2.4 Test conditions (for each series of tests; if applicable) 108
B.2.5 Short-time withstand current and peak withstand current test 109
B.2.6 No-load operation 109
B.2.7 By-pass making current test-duty 109
B.2.8 Insertion current test-duty 109
B.2.9 Oscillographic and other records 110
Annex C (informative) (Void) 111
Annex D (informative) Examples of by-pass switch ratings 112
Annex E (normative) By-pass switches used as the primary by-passing devices 119
Annex F (informative) Explanatory note regarding recovery voltage during reinsertion 121
Annex G (normative) Use of mechanical characteristics and related requirements 131
Bibliography 134

Figure 1 – Different layouts for series capacitor banks 16
Figure 2 – By-pass switch – Opening and closing operations 23
Figure 3 – By-pass switch – Close-open cycle 24
Figure 4 – By-pass switch – Open-close cycle 25
Figure 5 – Example of wind velocity measurement 64
Figure 6 – Test sequences for low and high temperature tests 65
Figure 7 – Equivalent testing set-up for unit testing of by-pass switches with more than one separate by-pass units 71
Figure 8 – Typical test circuit for the by-pass making current test-duty 77
Figure 9 – Oscillogram obtained from the typical test circuit for the by-pass making current test-duty 78
Figure 10 – Typical LC test circuit for the insertion current test-duty 81
Figure 11 – Oscillogram obtained from the typical LC test circuit for the insertion current test-duty 82
Figure 12 – Typical test circuit for the insertion current test-duty (mainly for high rated insertion current) 83
Figure 13 – Oscillogram obtained from the typical test circuit shown in Figure 12 for the insertion current test-duty 84
Figure 14 – Typical direct test circuit for the insertion current test-duty 85
Figure 15 – Oscillogram obtained from the typical direct test circuit for the insertion current test-duty 86
Figure 16 – Reference mechanical travel characteristics (idealized curve) 92
Figure E.1 – Typical component layout for by-pass switches used as the primary by-passing device 119
Figure F.1 – Typical example of the reinsertion voltage across a by-switch for a low compensation factor scheme (k = 0,2) and for a power swing of 1,8 p.u. 128
Figure F.2 – Typical example of the reinsertion voltage across a by-switch for a high compensation factor scheme (k = 0,5) and for a power swing of 1,8 p.u. 128
Figure F.3 – Comparison of the calculated reinsertion voltage examples and possible testing envelopes for 50 Hz systems 129

Figure F.4 – Comparison of the calculated reinsertion voltage examples and possible testing envelopes for 60 Hz systems 129
Figure G.1 – Reference mechanical travel characteristics (idealized curve) 132
Figure G.2 – Reference mechanical travel characteristics (idealized curve) with the prescribed envelopes centered over the reference curve (±5 %), contact separation in this example at time t = 20 ms 132
Figure G.3 – Reference mechanical travel characteristics (idealized curve) with the prescribed envelopes fully displaced upward from the reference curve ($^{+10}_{0}$ %), contact separation in this example at time t = 20 ms 133
Figure G.4 – Reference mechanical travel characteristics (idealized curve) with the prescribed envelopes fully displaced downward from the reference curve ($^{0}_{-10}$ %), contact separation in this example at time t = 20 ms 133

Table 1 – Number of mechanical operations 41
Table 2 – Nameplate information 45
Table 3 – Examples of static horizontal and vertical forces for static terminal load 48
Table 4 – Type tests 49
Table 5 – Invalid tests 50
Table 6 – Number of operating sequences 61
Table 7 – Limits of supply voltage for closing and opening releases 69
Table 8 – Test procedures for by-pass making current tests 79
Table 9 – Application of voltage for dielectric test on the main circuit 88
Table 10 – Test voltage for partial discharge test 90
Table A.1 – Tolerances on test quantities for type tests *(1 of 3)* 105
Table D.1 – Typical ratings for a series capacitor bank by-pass switch – Cases 1 to 6 113
Table D.2 – Typical series capacitor bank by-pass switch ratings – Cases 7 to 12 115
Table D.3 – Typical series capacitor bank by-pass switch ratings – Cases 13 to 18 117
Table F.1 – Typical examples of reinsertion voltages for systems not having power swing nor emergency overload, I_{load} = 1,0 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 122
Table F.2 – Typical examples of reinsertion voltages for systems not having power swing but with an emergency overload, I_{load} = 1,2 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 122
Table F.3 – Typical examples of reinsertion voltages for systems not having power swing but with an emergency overload, I_{load} = 1,4 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 123
Table F.4 – Typical examples of reinsertion voltages for systems not having power swing but with an emergency overload, I_{load} = 1,6 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 123
Table F.5 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 1,8 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 123
Table F.6 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 2,0 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 124
Table F.7 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 2,3 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 124
Table F.8 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 2,5 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 50 Hz 124

Table F.9 – Typical examples of reinsertion voltages for systems not having power swing nor emergency overload, I_{load} = 1,0 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 125
Table F.10 – Typical examples of reinsertion voltages for systems not having power swing but with an emergency overload, I_{load} = 1,2 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 125
Table F.11 – Typical examples of reinsertion voltages for systems not having power swing but with an emergency overload, I_{load} = 1,4 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 125
Table F.12 – Typical examples of reinsertion voltages for systems not having power swing but with an emergency overload, I_{load} = 1,6 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 126
Table F.13 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 1,8 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 126
Table F.14 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 2,0 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 126
Table F.15 – Typical examples of reinsertion voltages for systems having power swing, I_{load} = 2,3 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 127
Table F.16 – Typical examples of reinsertion recovery voltages for systems having power swing, I_{load} = 2,5 p.u.; U_{PL} = 2,2 p.u.; β = 0,85 and f = 60 Hz 127

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

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

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.

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

This third edition cancels and replaces the second edition published in 2008 and Amendment 1:2013. This edition constitutes a technical revision.

This edition contains the following significant technical changes with respect to the previous edition:

a) the document has been restructured according to edition 2.0 of IEC 62271-1;
b) the rated voltage assignation across the by-pass switch has been aligned to the rule defined in IEC 60143-1;
c) clarification has been given regarding rated continuous current of compensated and uncompensated line;
d) some clarifications have been given following a loss of "suitable precautions";

e) as per Amendment 2 of IEC 62271-100, the section "Rated time quantities" has been moved to Clause 6 under "Time quantities";

f) as per Amendment 2 of IEC 62271-100, the section "Test for static mechanical loads" have been moved to Clause 6 under "Static mechanical loads";

g) additional rules have been introduced for vacuum interrupters during impulse tests;

h) additional clarifications have been given regarding the number of reduced impulses during impulse tests;

i) a wider tolerance on the current damping during by-pass making current test-duty has been introduced.

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

FDIS	Report on voting
17A/1208/FDIS	17A/1215/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.

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 62271-100:2008 with its Amendment 1:2012 and Amendment 2:2017, and IEC 62271-1:2017, 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 62271-1:2017. 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 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

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

1 Scope

This part of IEC 62271 is applicable to AC 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 document is also applicable to the operating devices of by-pass switches and to their auxiliary equipment.

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.

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 60050-614:2016, *International Electrotechnical Vocabulary – Part 614: Generation, transmission and distribution of electricity – Operation*

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

IEC 60137:2017, *Insulated bushings for alternating voltages above 1000 V*

IEC 60143-1:2015, *Series capacitors for power systems – Part 1: General*

IEC 60143-2:2012, *Series capacitors for power systems – Part 2: Protective equipment for series capacitor banks*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

IEC 60376, *Specification of technical grade sulphur hexafluoride (SF_6) and complementary gases to be used in its mixtures for use in electrical equipment*

IEC 60480, *Guidelines for the checking and treatment of sulphur hexafluoride (SF_6) taken from electrical equipment and specification for its re-use*

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

IEC 62271-4, *High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF_6) and its mixtures*

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers*
IEC 62271-100:2008/AMD1:2012
IEC 62271-100:2008/AMD2:2017

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

IEC 62271-102:2018, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

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 60050-614, 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.

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

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

3.1 General terms and definitions

3.1.101
switchgear and controlgear
a general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures

[SOURCE: IEC 60050-441:2000, 441-11-01]

3.1.102
outdoor switchgear and controlgear
switchgear and controlgear suitable for installation in the open air, i.e. capable of withstanding wind, rain, snow, dirt deposits, condensation, ice and hoar frost

[SOURCE: IEC 60050-441:2000, 441-11-05]

3.1.103
short-circuit current
overcurrent resulting from a short circuit due to a fault or an incorrect connection in an electric circuit

[SOURCE: IEC 60050-441:2000, 441-11-07]

3.1.104
ambient air temperature
temperature, determined under prescribed conditions, of the air surrounding the complete switching device or fuse

Note 1 to entry: For switching devices or fuses installed inside an enclosure, it is the temperature of the air outside the enclosure.

[SOURCE: IEC 60050-441:2000, 441-11-13]

3.1.105
temperature rise
<of a part of a by-pass switch>
difference between the temperature of the part under consideration and the ambient air temperature

[SOURCE: IEC 60050-151:2001, 151-16-26, modified – "A reference" has been replaced by "the ambient air".]

3.1.106
overvoltage
<in an electric power system>
voltage:

- between one line conductor and earth or across a longitudinal insulation having a peak value exceeding the corresponding peak of the highest voltage of the system divided by $\sqrt{3}$

or;

- between phase conductors having a peak value exceeding the amplitude of the highest voltage of the system

[SOURCE: IEC 60050-614:2016, 614-03-10]

3.1.107
unit test
test carried out 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 atmospheric air, and along the surfaces in contact with atmospheric air of solid insulation of the equipment which are subject to dielectric stresses and to the effects of atmospheric and other environmental conditions from the site

Note 1 to entry: Examples of environmental conditions are pollution, humidity, vermin.

[SOURCE: IEC 60050-614:2016, 614-03-02]

3.1.109
internal insulation
internal distances of the solid, liquid or gaseous insulation of equipment, which are protected from the effects of atmospheric and other external conditions

[SOURCE: IEC 60050-614:2016, 614-03-03]