



High-voltage switchgear and controlgear

**Part 201: AC solid-insulation enclosed
switchgear and controlgear for
rated voltages above 1 kV and up
to and including 52 kV (IEC 62271-
201:2014, MOD)**



AS 62271.201:2019

This Australian Standard® was prepared by EL-007, Power Switchgear. It was approved on behalf of the Council of Standards Australia on 21 October 2019.

This Standard was published on 22 November 2019.

The following are represented on Committee EL-007:

Australian Industry Group
Energy Networks Australia
Engineers Australia
University of New South Wales

This Standard was issued in draft form for comment as DR AS IEC 62271.201:2019.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

ISBN 978 1 76072 635 5



High-voltage switchgear and controlgear

Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (IEC 62271- 201:2014, MOD)

Originates as AS 2264—1979.
Previous edition 1995.
Revised and redesignated as AS 62271.201—2008.
Second edition 2019.

COPYRIGHT

© IEC 2019 — All rights reserved
© Standards Australia Limited 2019

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Preface

This Standard was prepared by the Standards Australia Committee EL-007, Power Switchgear, to supersede AS 62271.201—2008, *High-voltage switchgear and controlgear, Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*.

The objective of this Standard is to specify requirements for prefabricated solid-insulation enclosed switchgear and controlgear for the following:

- (a) Alternating current of rated voltages above 1 kV and up to and including 52 kV for indoor installation.
- (b) Service frequencies up to and including 60 Hz.

Solid-insulation enclosed switchgear and controlgear for special use, for example, inflammable atmospheres, in mines or on board ships, may be subject to additional requirements.

Components contained in solid-insulation enclosed switchgear and controlgear are designed and tested in accordance with their various relevant standards.

This Standard supplements the Standards for the individual components regarding their installation in switchgear and controlgear assemblies.

This Standard 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 should be taken into account.

This Standard is an adoption with national modifications and has been reproduced from, IEC 62271-201:2014, *High-voltage switchgear and controlgear – Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*. The modifications are additional requirements and are set out in Appendix ZZ, which has been added at the end of the source text.

Appendix ZZ lists the variations to IEC 62271-201:2014 for the application of this Standard in Australia.

As this document has been reproduced from an International Standard, the following applies:

- (i) In the source text “this part of IEC 62271” should read “this Australian Standard”.
- (ii) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

NOTES

Currently in preview, click buy full version

CONTENTS

FOREWORD.....	8
1 General.....	10
1.1 Scope.....	10
1.2 Normative references.....	10
2 Normal and special service conditions.....	11
3 Terms and definitions.....	11
3.1 Index of definitions.....	19
4 Ratings.....	21
4.1 Rated voltage (U_r).....	21
4.1.2 Range II for rated voltages above 245 kV.....	21
4.2 Rated insulation level.....	22
4.3 Rated frequency (f_r).....	22
4.4 Rated normal current and temperature rise.....	22
4.4.1 Rated normal current (I_r).....	22
4.4.2 Temperature rise.....	22
4.5 Rated short-time withstand current (I_k).....	22
4.5.101 Rated short-time withstand current (I_k).....	22
4.5.102 Rated short-time phase to earth withstand current (I_{ke}).....	22
4.6 Rated peak withstand current (I_p).....	22
4.6.101 Rated peak withstand current (I_p).....	23
4.6.102 Rated peak phase to earth withstand current (I_{pe}).....	23
4.7 Rated duration of short circuit (t_k).....	23
4.7.101 Rated duration of short circuit (t_k).....	23
4.7.102 Rated duration of phase to earth short circuit (t_{ke}).....	23
4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits (U_a).....	23
4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits.....	23
4.10 Rated pressure of compressed gas supply for controlled pressure systems.....	23
4.11 Rated filling levels for insulation and/or operation.....	23
4.101 Rating of the internal arc classification (IAC).....	23
4.101.1 General.....	23
4.101.2 Types of accessibility.....	23
4.101.3 Classified sides.....	24
4.101.4 Rated arc fault currents (I_A , I_{Ae}).....	24
4.101.5 Rated arc fault duration (t_A , t_{Ae}).....	24
4.102 Rated cable test voltages.....	24
4.102.1 General.....	24
4.102.2 Rated power-frequency cable test voltage U_{ct} (a.c.).....	25
4.102.3 Rated d.c. cable test voltage U_{ct} (d.c.).....	25
5 Design and construction.....	25
5.1 Requirements for liquids in switchgear and controlgear.....	25
5.2 Requirements for gases in switchgear and controlgear.....	25
5.3 Earthing of switchgear and controlgear.....	26
5.3.101 Earthing of the high-voltage conductive parts.....	26
5.3.102 Earthing of the enclosure.....	26

5.3.103	Earthing of earthing devices	26
5.3.104	Earthing of withdrawable and removable parts	26
5.3.105	Earthing circuit	26
5.4	Auxiliary and control equipment	27
5.5	Dependent power operation	27
5.6	Stored energy operation.....	27
5.7	Independent manual or power operation (independent unlatched operation)	27
5.8	Operation of releases.....	27
5.9	Low- and high-pressure interlocking and monitoring devices	27
5.10	Nameplates.....	27
5.11	Interlocking devices	29
5.12	Position indication.....	29
5.13	Degrees of protection by enclosures	30
5.13.1	Protection of persons against access to hazardous parts and protection of the equipment against ingress of solid foreign objects (IP coding).....	30
5.13.2	Protection against ingress of water (IP coding).....	30
5.13.3	Protection of equipment against mechanical impact under normal service conditions (IK coding)	30
5.14	Creepage distances for outdoor insulators	30
5.15	Gas and vacuum tightness	30
5.16	Liquid tightness.....	30
5.17	Fire hazard (flammability)	30
5.18	Electromagnetic compatibility (EMC)	30
5.19	X-ray emission.....	30
5.20	Corrosion	30
5.101	Internal arc fault.....	31
5.102	Solid insulating enclosure	31
5.102.1	General	31
5.102.2	Protection category of the solid insulating enclosure against electric shock	31
5.102.3	Requirements for protection categories.....	32
5.102.4	Covers and doors	33
5.102.5	Partition or shutter being part of the enclosure	33
5.102.6	Inspection windows.....	34
5.102.7	Ventilating openings, vent outlets	34
5.103	High-voltage compartments.....	34
5.103.1	General	34
5.103.2	Fluid-filled compartments (gas or liquid)	35
5.103.3	Partitions and shutters.....	36
5.104	Removable parts.....	37
5.105	Provisions for dielectric tests on cables	37
6	Type tests	37
6.1	General.....	37
6.1.1	Grouping of tests	38
6.1.2	Information for identification of specimens	39
6.1.3	Information to be included in type-test reports	39
6.2	Dielectric tests	39
6.2.1	Ambient air conditions during tests	39

6.2.2	Wet test procedure	39
6.2.3	Conditions of switchgear and controlgear during dielectric tests	39
6.2.4	Criteria to pass the test	39
6.2.5	Application of the test voltage and test conditions	39
6.2.6	Tests of switchgear and controlgear of $U_T \leq 245$ kV	40
6.2.7	Tests of switchgear and controlgear of $U_T > 245$ kV	41
6.2.8	Artificial pollution tests for outdoor insulators	41
6.2.9	Partial discharge tests	41
6.2.10	Dielectric tests on auxiliary and control circuits	42
6.2.11	Voltage test as condition check	42
6.2.101	Dielectric tests on cable testing circuits	42
6.3	Radio interference voltage (r.i.v.) test	43
6.4	Measurement of the resistance of circuits	43
6.4.1	Main circuit	43
6.4.2	Auxiliary circuits	43
6.4.101	Requirement for protection category PB2	43
6.5	Temperature-rise tests	43
6.5.1	Conditions of the switchgear and controlgear to be tested	44
6.5.2	Arrangement of the equipment	44
6.5.3	Measurement of the temperature and the temperature rise	44
6.5.4	Ambient air temperature	44
6.5.5	Temperature-rise test of the auxiliary and control equipment	44
6.5.6	Interpretation of the temperature-rise tests	44
6.6	Short-time withstand current and peak withstand current tests	44
6.6.1	Arrangement of the switchgear and controlgear and of the test circuit	45
6.6.2	Test current and duration	46
6.6.3	Behaviour of switchgear and controlgear during test	46
6.6.4	Condition of switchgear and controlgear after test	46
6.7	Verification of the protection	46
6.7.1	Verification of the IP coding	46
6.7.2	Verification of the IK coding	46
6.8	Tightness tests	46
6.9	Electromagnetic compatibility tests (EMC)	46
6.10	Additional tests on auxiliary and control circuits	46
6.10.1	General	46
6.10.2	Functional tests	46
6.10.3	Electrical continuity of earthed metallic parts test	46
6.10.4	Verification of the operational characteristics of auxiliary contacts	47
6.10.5	Environmental tests	47
6.10.6	Dielectric test	47
6.11	X-radiation test procedures for vacuum interrupters	47
6.101	Verification of making and breaking capacities	47
6.101.1	General	47
6.101.2	Test requirements for main switching devices	48
6.101.3	Test requirements for earthing function	48
6.102	Mechanical operation tests	48
6.102.1	Switching devices and removable parts	48

6.102.2	Interlocks.....	49
6.103	Pressure withstand test for gas-filled compartments.....	50
6.103.1	Pressure withstand test for gas-filled compartments with pressure relief devices.....	50
6.103.2	Pressure withstand test for gas-filled compartments without pressure relief devices.....	50
6.104	Tests to prove the protection of persons against electric shock.....	50
6.104.1	General.....	50
6.104.2	Dielectric tests.....	50
6.104.3	Measurements of leakage currents.....	51
6.105	Internal arcing test.....	51
6.105.1	General.....	51
6.105.2	Test conditions.....	52
6.105.3	Arrangement of the equipment.....	53
6.105.4	Test procedure.....	53
6.105.5	Criteria to pass the test.....	53
6.105.6	Test report.....	54
6.105.7	Transferability of test results.....	55
6.106	Thermal stability test.....	55
6.107	Humidity test.....	55
7	Routine tests.....	55
7.1	Dielectric test on the main circuit.....	56
7.2	Tests on auxiliary and control circuits.....	56
7.3	Measurement of the resistance of the main circuit.....	56
7.4	Tightness test.....	57
7.5	Design and visual checks.....	57
7.101	Partial discharge test.....	57
7.102	Mechanical operation tests.....	57
7.103	Pressure tests of gas-filled compartments.....	57
7.104	Tests of auxiliary electrical, pneumatic and hydraulic devices.....	57
7.105	Tests after erection on site.....	58
7.106	Measurement of fluid condition after filling on site.....	58
8	Guide to the selection of switchgear and controlgear.....	58
8.101	General.....	58
8.102	Selection of rated values.....	59
8.103	Selection of design and construction.....	59
8.103.1	General.....	59
8.103.2	Architecture and accessibility to high-voltage compartments.....	60
8.103.3	Service continuity of the switchgear and controlgear.....	60
8.103.4	Partition classes.....	63
8.104	Internal arc fault.....	63
8.104.1	General.....	63
8.104.2	Causes and preventive measures.....	63
8.104.3	Supplementary protective measures.....	63
8.104.4	Considerations for the selection and installation.....	64
8.104.5	Internal arc test.....	65
8.104.6	IAC classification.....	65
8.105	Summary of technical requirements, ratings and optional tests.....	66
8.106	Ratings of earthing circuits.....	68

8.107	Ratings for cable testing	69
9	Information to be given with enquiries, tenders and orders	69
9.1	Information with enquiries and orders	69
9.2	Information with tenders.....	70
10	Transport, storage, installation, operation and maintenance	70
10.1	Conditions during transport, storage and installation	70
10.2	Installation	70
10.2.3	Mounting	71
10.3	Operation.....	71
10.4	Maintenance	71
11	Safety.....	71
11.101	Procedures	71
11.102	Internal arc aspects	71
12	Influence of the product on the environment	72
Annex AA (normative)	Internal arc fault – Method to verify the internal arc classification (IAC).....	73
AA.1	Room simulation	73
AA.2	Indicators (for assessing the thermal effects of the gases)	75
AA.2.1	General	75
AA.2.2	Arrangement of indicators.....	75
AA.3	Tolerances for geometrical dimensions of test arrangements	76
AA.4	Test parameters.....	76
AA.4.1	General	76
AA.4.2	Voltage.....	76
AA.4.3	Current.....	77
AA.4.4	Frequency	77
AA.5	Test procedure.....	77
AA.5.1	Supply circuit	77
AA.5.2	Arc initiation	78
Annex BB (normative)	Partial discharge measurement.....	84
BB.1	General.....	84
BB.2	Application.....	84
BB.3	Test circuits and measuring instruments	84
BB.4	Test procedure.....	85
Annex CC (informative)	Regional deviations	89
Annex DD (normative)	Humidity test	90
DD.1	General.....	90
DD.2	Test procedure and test conditions	90
DD.2.1	Test cycle and its duration	90
DD.2.2	Generation of fog.....	91
DD.2.3	High air temperature period	91
DD.2.4	Test chamber.....	91
DD.2.5	Test object.....	91
DD.2.6	Test voltage and voltage supply.....	92
DD.2.7	Total test duration.....	92
DD.3	Test criteria and evaluation	92
DD.3.1	Criterion during the test	92
DD.3.2	Criterion after the test.....	92

DD.3.3 Evaluation of the test	92
Annex EE (informative) Protection categories	94
EE.1 Protection category PA	94
EE.2 Protection category PB	95
Annex FF (informative) List of symbols and abbreviations used in IEC 62271-201	96
Bibliography.....	97
Figure 101 – LSC1.....	62
Figure 102 – LSC2.....	62
Figure 103 – LSC2.....	62
Figure 104 – LSC2A	62
Figure 105 – LSC2B	62
Figure 106 – LSC2B	62
Figure AA.1 – Mounting frame for vertical indicators	80
Figure AA.2 – Horizontal indicator.....	80
Figure AA.3 – Position of the indicators	81
Figure AA.4 – Room simulation and indicator positioning for accessibility A, classified rear side, functional unit of any height	82
Figure AA.5 – Ceiling height stated from the floor or false floor level where the switchgear is actually placed	83
Figure BB.1 – Partial discharge test circuit (three-phase arrangement).....	87
Figure BB.2 – Partial discharge test circuit (system without earthed neutral).....	88
Figure DD.1 – Test cycle	93
Figure DD.2 – Test chamber	93
Figure EE.1 – Possible designs for protection category PA.....	94
Figure EE.2 – Possible designs for protection category PB	95
Table 101 – Nameplate information	28
Table 102 – Locations, causes and examples of measures to decrease the probability of internal arc faults	64
Table 103 – Single phase-to-earth arc fault current depending on the network neutral earthing	66
Table 104 – Summary of technical requirements, ratings and optional tests for solid-insulation enclosed switchgear	67
Table AA.1 – Parameters for internal arc fault test according to compartment construction.....	79
Table BB.1 – Test circuits and procedures.....	86

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

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 62271-201 has been prepared by subcommittee 17C: High-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear.

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

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

- a) apart from updating with the second edition of IEC 62271-200 (issued in 2011), definitions, classifications and testing procedures have been specified more precisely;
- b) access to the solid-insulation enclosed switchgear and controlgear is now restricted to authorized personnel only. This implies that “accessibility class B” (public access) has been deleted throughout the document;

- c) the term “protection category” has been introduced to replace the term “protection grade” (PA, PB1 and PB2)

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

FDIS	Report on voting
17C/594/FDIS	17C/597/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.

This standard should be read in conjunction with IEC 62271-1:2007 and its Amendment 1:2011, to which it refers and which is applicable, unless otherwise specified. 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 numbering, whilst additional subclauses are numbered from 101.

The reader's attention is drawn to the fact that Annex CC lists all of the “in-some-country” clauses on differing practices of a less permanent nature relating to the subject of this standard.

A list of all parts in 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 publication will remain unchanged until the stability 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.

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 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

1 General

1.1 Scope

This part of IEC 62271 specifies requirements for prefabricated solid-insulation enclosed switchgear and controlgear for alternating current of rated voltages above 1 kV and up to and including 52 kV for indoor installation and for service frequencies up to and including 60 Hz.

Access to the switchgear and controlgear is restricted to authorized personnel.

NOTE 1 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 Bibliography.

NOTE 2 Although primarily dedicated to three-phase systems, this standard can also be applied to single-phase or two-phase systems.

Enclosures may include fixed and removable components and may be filled with fluid (liquid or gas) to provide an extra insulation. For switchgear and controlgear containing gas-filled compartments, the design pressure is limited to a maximum of 300 kPa (relative pressure).

Solid-insulation enclosed switchgear and controlgear complying with this standard can be safely touched when energised.

Solid-insulation enclosed switchgear and controlgear for special use, for example, in flammable atmospheres, in mines or on board ships, may be subject to additional requirements.

Components contained in solid-insulation enclosed switchgear and controlgear are designed and tested in accordance with their various relevant standards. This standard supplements the standards for the individual components regarding their installation in switchgear and controlgear assemblies.

This standard 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 should be taken into account.

NOTE 3 Switchgear and controlgear assemblies having a metal enclosure are covered by IEC 62271-200 refer to [9] of Bibliography.

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.

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)