



High-voltage switchgear and controlgear

Part 102: Alternating current disconnectors and earthing switches (IEC 62271-102:2018, MOD)

STANDARDS
Australia



AS 62271.102:2019

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 62271.102:2019.

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 638 6



High-voltage switchgear and controlgear

Part 102: Alternating current disconnectors and earthing switches (IEC 62271-102:2018, MOD)

Originates as AS 1306—1985 and AS 4298—1995.
Revised, amalgamated and redesignated as AS 62271.102—2005.
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 Committee EL-007, Power Switchgear, to supersede AS 62271.102—2005, *High voltage switchgear and controlgear — Part 102: Alternating current disconnectors and earthing switches (IEC 62271-102, Ed.1.0 (2003) MOD)*.

The objective of this Standard is to specify the applications to alternating current disconnectors and earthing switches, designed for indoor and outdoor installations for nominal voltages above 1 000 V and for service frequencies up to and including 60 Hz.

This Standard also applies to the following:

- (a) Operating devices of the above disconnectors and earthing switches and their auxiliary equipment.
- (b) Switching devices having disconnecting and/or earthing functionalities apart from other functions, such as high-speed earthing switch, circuit-breaker and switch-disconnector.

This Standard does not cover disconnectors in which the fuse forms an integral part.

This Standard is an adoption with national modifications, and has been reproduced from, IEC 62271-102:2018, *High-voltage switchgear and controlgear — Part 102: Alternating current disconnectors and earthing switches*.

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 62271-102:2018 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.

6.4	Auxiliary and control equipment and circuits	35
6.5	Dependent power operation	35
6.6	Stored energy operation.....	35
6.7	Independent unlatched operation (independent manual or power operation)	35
6.8	Manually operated actuators	35
6.9	Operation of releases.....	35
6.10	Pressure/level indication	35
6.11	Nameplates.....	35
6.12	Locking devices	38
6.13	Position indication.....	38
6.14	Degree of protection provided by enclosures	38
6.15	Creepage distances for outdoor insulators	38
6.16	Gas and vacuum tightness.....	38
6.17	Tightness for liquid systems.....	38
6.18	Fire hazard (flammability)	38
6.19	Electromagnetic compatibility (EMC).....	38
6.20	X-ray emission	38
6.21	Corrosion	38
6.22	Filling levels for insulation, switching and/or operation.....	39
6.101	Particular requirements for earthing switches.....	39
6.102	Requirements in respect of the isolating distance of disconnectors	39
6.103	Mechanical strength.....	39
6.104	Operation of disconnectors and earthing switches – Position of the movable contact system and its indicating and signalling devices	40
6.104.1	Securing of position	40
6.104.2	Additional requirements for power-operated mechanisms	40
6.104.3	Indication and signalling of position.....	40
6.105	Maximum force required for manual (dependent or independent) operation.....	41
6.105.1	General	41
6.105.2	Operation requiring more than one revolution	42
6.105.3	Operation requiring up to one revolution	42
6.106	Dimensional tolerances.....	42
6.107	Earthing switches with short-circuit making current capability	42
7	Type tests	42
7.1	General.....	42
7.1.1	Basics	42
7.1.2	Information for identification of test objects.....	44
7.1.3	Information to be included in type test reports	44
7.2	Dielectric tests	44
7.2.1	General	44
7.2.2	Ambient air conditions during tests	44
7.2.3	Wet test procedure	44
7.2.4	Arrangement of the equipment.....	44
7.2.5	Criteria to pass the test	45
7.2.6	Application of the test voltage and test conditions.....	45
7.2.7	Tests of disconnectors and earthing switches of $U_T \leq 245$ kV.....	45
7.2.8	Test of disconnectors and earthing switches of $U_T > 245$ kV	45
7.2.9	Artificial pollution tests for outdoor insulators.....	45
7.2.10	Partial discharge tests	46

7.2.11	Dielectric tests on auxiliary and control circuits	46
7.2.12	Voltage test as condition check	46
7.3	Radio interference voltage (RIV) test	46
7.4	Resistance measurement	46
7.5	Continuous current tests	46
7.6	Short-time withstand current and peak withstand current tests	46
7.6.1	General	46
7.6.2	Arrangement of the disconnectors and earthing switches and of the test circuit	46
7.6.3	Test current and duration	52
7.6.4	Conditions of disconnectors and earthing switches after test	52
7.7	Verification of the protection	53
7.8	Tightness tests	53
7.9	Electromagnetic compatibility tests (EMC)	53
7.10	Additional tests on auxiliary and control circuits	53
7.11	X-ray radiation test for vacuum interrupters	53
7.101	Test to prove the short-circuit making performance of earthing switches	54
7.101.1	General test conditions	54
7.101.2	Arrangement of the earthing switch for tests	54
7.101.3	Test frequency	54
7.101.4	Test voltage	54
7.101.5	Test short-circuit making current	55
7.101.6	Test circuits	55
7.101.7	Test procedures	55
7.101.8	Behaviour of earthing switches when making short-circuit currents	56
7.101.9	Condition of earthing switch after short-circuit making tests	56
7.101.10	Invalid tests	57
7.101.11	Type test reports	57
7.102	Operating and mechanical endurance tests	58
7.102.1	General test conditions	58
7.102.2	Contact zone test	58
7.102.3	Mechanical endurance test	61
7.102.4	Operation during the application of rated static mechanical terminal loads	63
7.102.5	Extended mechanical endurance tests	64
7.102.6	Testing of mechanical interlocking devices	65
7.103	Operation under severe ice conditions	65
7.103.1	General	65
7.103.2	Test arrangement	65
7.103.3	Test procedure	66
7.104	Low- and high-temperature tests	67
7.104.1	General	67
7.104.2	Measurement of ambient air temperature	68
7.104.3	Low-temperature test	68
7.104.4	High-temperature test	70
7.105	Tests to verify the proper functioning of the position-indicating device	70
7.105.1	General	70
7.105.2	Tests on the power kinematic chain and the position-indicating kinematic chain	71
7.106	Bus-transfer current switching tests on disconnectors	71

7.106.1	General	71
7.106.2	Making and breaking tests	71
7.107	Induced current switching tests on earthing switches	75
7.107.1	General	75
7.107.2	Arrangement of the earthing switch for tests	75
7.107.3	Earthing of test circuit and earthing switch	76
7.107.4	Test frequency	76
7.107.5	Test voltage	76
7.107.6	Test currents	76
7.107.7	Test circuits	76
7.108	Bus-charging current switching tests on disconnectors	81
7.108.1	General	81
7.108.2	Test duties	82
7.108.3	Arrangement of the disconnector for tests	82
7.108.4	Test frequency	82
7.108.5	Test voltages for making and breaking tests	83
7.108.6	Test circuits for making and breaking tests	84
7.108.7	Performance of making and breaking tests	86
7.108.8	Behaviour of the disconnector during making and breaking tests	86
7.108.9	Condition after test	87
7.108.10	Type test reports	87
7.108.11	Requirements for U_{TVE} measurements	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	89
8.4	Measurement of the resistance of the main circuit	89
8.5	Tightness test	89
8.6	Design and visual check	89
8.101	Mechanical operating tests	89
8.102	Verification of earthing function	90
9	Guide to the selection of disconnectors and earthing switches (informative)	90
9.1	General	90
9.2	Selection of rated values	91
9.2.101	General	91
9.2.102	Selection of rated voltage and rated insulation level	91
9.2.103	Selection of rated continuous current	91
9.2.104	Selection of rated contact zone	91
9.2.105	Selection of rated static mechanical terminal load	92
9.2.106	Selection of a bus-transfer current switching capability for disconnectors of $U_r > 52$ kV	92
9.2.107	Selection of an induced-current switching capability for earthing switches of $U_r > 52$ kV	92
9.2.108	Selection of rated short-time withstand current and of rated duration of short-circuit	92
9.2.109	Selection of rated peak withstand current and of rated short-circuit making current for earthing switches	93
9.2.110	Selection of short-circuit making capability for earthing switches	93
9.3	Cable-interface considerations	93

9.4	Continuous or temporary overload due to changed service conditions.....	93
9.5	Environmental aspects.....	93
9.5.101	Local environmental conditions.....	93
10	Information to be given with enquiries, tenders and orders (informative).....	94
10.1	General.....	94
10.2	Information with enquiries and orders.....	94
10.3	Information with tenders.....	95
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	Operation.....	97
11.5	Maintenance.....	97
12	Safety.....	97
12.1	General.....	97
12.2	Precautions by manufacturers.....	97
12.3	Precautions by users.....	97
13	Influence of the product on the environment.....	97
	Annex A (informative) Test voltage for the most disadvantageous dielectric position of an earthing switch during operation (minimum temporary clearance).....	98
	Annex B (informative) Current-switching capability required of disconnectors and earthing switches.....	99
B.1	Bus-transfer current switching capability of disconnectors.....	99
B.2	Bus-charging current switching capability of disconnectors.....	99
B.3	Induced current-switching capability of earthing switches.....	100
	Annex C (normative) Tolerances on test quantities for type tests.....	101
	Annex D (normative) Alternative test methods for short-circuit current making tests.....	103
D.1	General.....	103
D.2	Alternative methods.....	103
D.2.1	Synthetic test method with both rated voltage and rated short-circuit current.....	103
D.2.2	Test method with reduced voltage.....	103
	Annex E (informative) Extension of validity of type tests.....	105
E.1	General.....	105
E.2	Dielectric tests.....	105
E.3	Short-time withstand current tests.....	105
E.4	Short-circuit making performance of earthing switches.....	105
E.5	Operating and mechanical endurance tests.....	105
E.6	Bus-transfer current switching tests on disconnectors.....	105
E.7	Induced current switching tests on earthing switches.....	106
	Bibliography.....	107
	Figure 1 – Position indicating/signalling device(s).....	40
	Figure 2 – Three-phase test arrangement for disconnectors and earthing switches.....	48
	Figure 3 – Single-phase test arrangement for disconnectors with a horizontal isolating distance and for earthing switches of $U_T > 52$ kV, to be used with flexible or with rigid conductors.....	49

Figure 4 – Single-phase test arrangement for divided support disconnectors (earthing switches) of $U_T > 52$ kV with a vertical isolating distance, to be used with flexible conductors	50
Figure 5 – Single-phase test arrangement for divided support disconnectors (earthing switches) of $U_T > 52$ kV with a vertical isolating distance, to be used with rigid conductors	51
Figure 6 – Fixed contact parallel to support	59
Figure 7 – Fixed contact perpendicular to support	60
Figure 8 – Example of the application of rated static mechanical terminal loads to a (divided support) pantograph disconnector (or earthing switch)	61
Figure 9 – Example of the application of rated static mechanical terminal loads to a two-column disconnector	61
Figure 10 – Test sequences for low and high temperature tests	68
Figure 11 – Example of test circuit for bus-transfer current switching tests	73
Figure 12 – Test circuit for electromagnetically induced current switching tests	77
Figure 13 – Test circuits for electrostatically induced current-switching tests	79
Figure 14 – Test circuit for test duty 1	83
Figure 15 – Typical voltage waveform (Including VFT and FT components)	85
Figure 16 – Test circuit for test duty 2	85
Figure 17 – Test circuit for test duty 3	86
Figure B.1 – Examples of resistor-fitted disconnectors	100
Table 1 – Classification of earthing switches for short-circuit making	28
Table 2 – Preferred contact zones for "fixed" contacts supported by flexible conductors	29
Table 3 – Preferred contact zones for "fixed" contacts supported by rigid conductors	29
Table 4 – Preferred static mechanical terminal loads	30
Table 5 – Classification of disconnectors for mechanical endurance	31
Table 6 – Classification of earthing switches for mechanical endurance	31
Table 7 – Rated bus-transfer voltages of disconnectors	32
Table 8 – Classification of earthing switches for induced-current switching	32
Table 9 – Rated induced currents and voltages	33
Table 10 – Classification of disconnectors for bus-charging switching	34
Table 11 – Standard rated bus-charging currents	34
Table 12 – Product information	36
Table 13 – List of type tests	43
Table 14 – Power frequency withstand voltages	45
Table 15 – Requirements on the instant of making	56
Table 16 – Invalid tests	57
Table 17 – Standard values of recovery voltages for electromagnetically induced current breaking tests	78
Table 18 – Test circuit capacitances (C_1 values) for electrostatically induced current switching tests	80
Table 19 – Test voltages for making and breaking tests	83
Table 20 – Number of tests	86

Table 21 – Power frequency voltage tests	89
Table B.1 – Average impedances.....	99
Table C.1 – Tolerances on test quantities for type tests	101

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –**Part 102: Alternating current disconnectors and earthing 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 62271-102 has been prepared by subcommittee 17A: Switching devices, of IEC technical committee 17: High-voltage switchgear and controlgear.

This second edition cancels and replaces the first edition published in 2001, Amendment 1:2011 and Amendment 2:2013. This edition constitutes a technical revision.

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

- a) new numbering according to IEC 17/1025/RQ to harmonize with ISO/IEC Directives, Part 2, and IEEE Std. C37.100.1;
- b) clause numbering has been aligned with IEC 62271-1:2017;
- c) the Scope has been extended to cover all indoor and outdoor installations. Consideration of switching devices having disconnecting and/or earthing switch functionalities, apart from other functions, are also covered by this document;

- d) ratings have been moved from Annexes B, C and E to Clause 5; the order of the subclauses now corresponds to the order of subclauses in Clause 7;
- e) new rating values for bus-transfer current and bus-transfer voltage have been assigned;
- f) new class of mechanical endurance for earthing switches has been added (M1);
- g) subclause "Rated values of electrical endurance for earthing switches" is now called "Classification of earthing switches for short-circuit making capability";
- h) new subclause with ratings for ice-coating has been added;
- i) new subclause with classification of bus-charging switching capability has been added;
- j) new withstand requirements for interlocking devices have been added;
- k) the way to comply with the requirements of the isolating distance of disconnectors has been modified;
- l) design and construction requirements for position-indicating devices have been modified, aligning the requirements for position indication and signalling;
- m) the value of the operating force has been changed;
- n) the test procedures and validation criteria have been revised and modified where necessary;
- o) requirements for applied voltage during single-phase test on non-simultaneous closing earthing switches have been changed;
- p) non-verifiable requirements have been deleted;
- q) a new subclause has been added for testing mechanical interlocking devices;
- r) the high- and low-temperature test is mandatory if the temperature limits for the service conditions of the apparatus (defined by the manufacturer) are above +40 °C or below –5 °C, and a more detailed testing procedure is given;
- s) the testing procedure to verify the proper functioning of the position-indicating device allows a more practicable testing for every technology used;
- t) a new Annex B has been added with title: "Current-switching capability required of disconnectors and earthing switches";
- u) a new Annex C has been added with title: "Tolerances on test quantities for type tests";
- v) a new Annex E has been added with title: "Extension of validity of type tests".

This standard is to be read in conjunction with IEC 62271-1:2017, 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, except annexes, is used as in IEC 62271-1:2017. Additional subclauses are numbered from 101.

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

FDIS	Report on voting
17A/1173/FDIS	17A/1180/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 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 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 102: Alternating current disconnectors and earthing switches

1 Scope

This part of IEC 62271 applies to alternating current disconnectors and earthing switches, designed for indoor and outdoor installations for nominal voltages above 1 000 V and for service frequencies up to and including 60 Hz.

It also applies to the operating devices of these disconnectors and earthing switches and their auxiliary equipment.

Additional requirements for disconnectors and earthing switches in enclosed switchgear and controlgear are given in IEC 62271-200, IEC 62271-201 and IEC 62271-203.

NOTE Disconnectors in which the fuse forms an integral part are not covered by this standard.

This document is also applicable to switching devices having disconnecting and/or earthing functionalities apart from other functions, such as high-speed earthing switch, circuit-breaker and switch-disconnector.

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, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

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

IEC 60050-471, *International Electrotechnical Vocabulary – Part 471: Insulators*

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

IEC 60071-2, *Insulation co-ordination – Part 2: Application guide*

IEC 60137, *Insulating bushings for alternating voltages above 1 000 V*

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

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60865-1, *Short-circuit currents – Calculation of effects – Part 1: Definitions and calculation methods*