

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**High-voltage switchgear and controlgear –
Part 1: Common specifications**

**Appareillage à haute tension –
Partie 1: Spécifications communes**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00



IEC 62271-1

Edition 1.1 2011-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**High-voltage switchgear and controlgear –
Part 1: Common specifications**

**Appareillage à haute tension –
Partie 1: Spécifications communes**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

CR

ICS 29.130.10; 29.130.99

ISBN 978-2-88912-607-1

CONTENTS

FOREWORD.....	6
1 General.....	8
1.1 Scope.....	8
1.2 Normative references.....	8
2 Normal and special service conditions.....	12
2.1 Normal service conditions.....	13
2.2 Special service conditions.....	14
3 Terms and definitions.....	16
3.1 General terms.....	16
3.2 Assemblies of switchgear and controlgear.....	19
3.3 Parts of assemblies.....	19
3.4 Switching devices.....	20
3.5 Parts of switchgear and controlgear.....	20
3.6 Operation.....	26
3.7 Characteristic quantities.....	29
3.8 Index of definitions.....	30
4 Ratings.....	32
4.1 Rated voltage (U_r).....	33
4.2 Rated insulation level.....	33
4.3 Rated frequency (f_r).....	37
4.4 Rated normal current and temperature rise.....	37
4.5 Rated short-time withstand current (I_k).....	40
4.6 Rated peak withstand current (I_p).....	40
4.7 Rated duration of short circuit (t_k).....	41
4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits (U_a).....	41
4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits.....	43
4.10 Rated pressure of compressed gas supply for controlled pressure systems.....	43
4.11 Rated filling levels for insulation and/or operation.....	43
5 Design and construction.....	43
5.1 Requirements for liquids in switchgear and controlgear.....	43
5.2 Requirements for gases in switchgear and controlgear.....	43
5.3 Earthing of switchgear and controlgear.....	44
5.4 Auxiliary and control equipment.....	44
5.5 Dependent power operation.....	50
5.6 Stored energy operation.....	50
5.7 Independent manual or power operation (independent unlatched operation).....	51
5.8 Operation of releases.....	51
5.9 Low- and high-pressure interlocking and monitoring devices.....	52
5.10 Nameplates.....	52
5.11 Interlocking devices.....	53
5.12 Position indication.....	53
5.13 Degrees of protection provided by enclosures.....	54
5.14 Creepage distances for outdoor insulators.....	55
5.15 Gas and vacuum tightness.....	56

5.16	Liquid tightness	56
5.17	Fire hazard (flammability)	57
5.18	Electromagnetic compatibility (EMC)	57
5.19	X-ray emission	57
5.20	Corrosion	58
6	Type tests	58
6.1	General	58
6.2	Dielectric tests	60
6.3	Radio interference voltage (r.i.v.) test.....	67
6.4	Measurement of the resistance of circuits.....	67
6.5	Temperature-rise tests	68
6.6	Short-time withstand current and peak withstand current tests	71
6.7	Verification of the protection.....	73
6.8	Tightness tests	74
6.9	Electromagnetic compatibility tests (EMC).....	76
6.10	Additional tests on auxiliary and control circuits	82
6.11	X-radiation test procedure for vacuum interrupters	86
7	Routine tests	88
7.1	Dielectric test on the main circuit.....	88
7.2	Tests on auxiliary and control circuits.....	88
7.3	Measurement of the resistance of the main circuit	89
7.4	Tightness test.....	89
7.5	Design and visual checks	90
8	Guide to the selection of switchgear and controlgear.....	90
8.1	Selection of rated values	91
8.2	Continuous or temporary overload due to changed service conditions	91
9	Information to be given with enquiries, tenders and orders	92
9.1	Information with enquiries and orders	93
9.2	Information with tenders	93
10	Transport, storage, installation, operation and maintenance	94
10.1	Conditions during transport, storage and installation	94
10.2	Installation	94
10.3	Operation	96
10.4	Maintenance.....	96
11	Safety.....	99
11.1	Precautions by manufacturers	100
11.2	Precautions by users.....	100
11.3	Electrical aspects	100
11.4	Mechanical aspects.....	101
11.5	Thermal aspects.....	101
11.6	Operation aspects	101
12	Influence of the product on the environment	101
	Annex A (normative) Identification of test specimens	102
	Annex B (normative) Determination of the equivalent r.m.s. value of a short-time current during a short circuit of a given duration	104
	Annex C (normative) Method for the weatherproofing test for outdoor switchgear and controlgear	105

Annex D (normative) Requirements for auxiliary and control circuit components	108
Annex E (informative) Tightness (information, example and guidance).....	110
Annex F (normative) Tolerances on test quantities during tests	112
Annex G (informative) Information and technical requirements to be given with enquiries, tenders and orders	115
Annex H (informative) Corrosion: Information regarding service conditions and recommended test requirements	118
Annex I (informative) List of symbols and abbreviations used in IEC 62271-1	119
Annex J (informative) Electromagnetic compatibility on site	121
Annex K (informative) List of notes concerning certain countries.....	122
Bibliography.....	123
Figure 1 – Altitude correction factor	15
Figure 2 – Examples of classes of contacts	49
Figure 3 – Diagram of connections of a three-pole switching device.....	63
Figure 4 – Diagram of a test circuit for the radio interference voltage test	77
Figure 5 – Test location of radiation meter	87
Figure B.1 – Determination of short-time current.....	104
Figure C.1 – Arrangement for weatherproofing test.....	106
Figure C.2 – Nozzle for weatherproofing test	107
Figure E.1 – Example of a tightness coordination chart, TC, for closed pressure systems	110
Figure E.2 – Sensitivity and applicability of different leak-detection methods for tightness tests	111
Table 1a – Rated insulation levels for rated voltages of range I, series I.....	34
Table 1b – Rated insulation levels for rated voltages of range I, series II (based on current practice in some areas, including North America) ^a	35
Table 2a – Rated insulation levels for rated voltages of range II	36
Table 2b – Additional rated insulation levels, based on current practice in some areas, including North America for range II.....	37
Table 3 – Limits of temperature and temperature rise for various parts, materials and dielectrics of high-voltage switchgear and controlgear	38
Table 4 – Direct current voltage	41
Table 5 – Alternating current voltage	42
Table 6 – Auxiliary contact classes	48
Table 7 – Degrees of protection.....	55
Table 8 – Example of grouping	58
Table 9 – Test conditions in general case	62
Table 10 – Power-frequency test conditions.....	63
Table 11 – Impulse test conditions.....	64
Table 12 – Test conditions for the alternative method	65
Table 13 – Permissible temporary leakage rates for gas systems	75
Table 14 – Application of voltages at the fast transient/burst test.....	80

Table 15 – Application of voltage at the damped oscillatory wave test	81
Table 16 – Assessment criteria for transient disturbance immunity	81
Table D.1 – List of reference documents for auxiliary and control circuit components	108
Table F.1 – Tolerances on test quantities for type test	113

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 1: Common specifications

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.

This consolidated version of IEC 62271-1 consists of the first edition (2007) [documents 17A/799/FDIS and 17A/804/RVD] and its amendment 1 (2011) [documents 17A/962/FDIS and 17A/970/RVD]. It bears the edition number 1.1.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.

International Standard IEC 62271-1 has been prepared by subcommittee 17A: High-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

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

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

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

The committee has decided that the contents of the base publication and its amendments 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 publication using a colour printer.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 1: Common specifications

1 General

1.1 Scope

This part of IEC 62271 applies to a.c. switchgear and controlgear designed for indoor and outdoor installation and for operation at service frequencies up to and including 60 Hz on systems having voltages above 1 000 V.

This standard applies to all high-voltage switchgear and controlgear except as otherwise specified in the relevant IEC standards for the particular type of switchgear and controlgear.

NOTE For the use of this standard, high voltage (see IEC 601-01-27) is the rated voltage above 1 000 V. However, the term medium voltage (see IEC 601-01-28) is commonly used for distribution systems with voltages above 1 kV and generally applied up to and including 52 kV.

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 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60038:1983, *IEC standard voltages*

IEC 60050-131, *International Electrotechnical Vocabulary (IEV) – Part 131: Circuit theory*

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

IEC 60050-191, *International Electrotechnical Vocabulary (IEV) – Chapter 191: Dependability and quality of service*

IEC 60050-351, *International Electrotechnical Vocabulary (IEV) – Part 351: Control technology*

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

IEC 60050-446, *International Electrotechnical Vocabulary (IEV) – Chapter 446: Electrical relays*

IEC 60050-551, *International Electrotechnical Vocabulary (IEV) – Power electronics*

IEC 60050-581, *International Electrotechnical Vocabulary (IEV) – Chapter 581: Electro-mechanical components for electronic equipment*

IEC 60050-601, *International Electrotechnical Vocabulary (IEV) – Chapter 601: Generation, transmission and distribution of electricity – General*

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