

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Coupling capacitors and capacitor dividers -
Part 1: General rules**

**Condensateurs de couplage et diviseurs capacitifs -
Partie 1: Règles générales**

IEC 60358-1:2025

<https://standards.iteh.ai/catalog/standards/iec/231c82f0-f454-4ad0-93d1-1fba99c26764/iec-60358-1-2025>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2025 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 l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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	5
INTRODUCTION	7
1 Scope	9
2 Normative references	9
3 Terms, definitions, symbols and abbreviated terms	10
3.1 General	10
3.2 Coupling capacitor and capacitor divider specifics	14
4 Normal and special environmental conditions	16
4.1 General	16
4.2 Normal service conditions	16
4.2.1 Ambient air temperature	16
4.2.2 Altitude	16
4.2.3 Vibrations or earthquakes	16
4.2.4 Other service conditions for indoor equipment	16
4.2.5 Other service conditions for outdoor equipment	17
4.3 Special service conditions	17
4.3.1 General	17
4.3.2 Altitude	17
4.3.3 Ambient temperature	18
4.3.4 Earthquakes	19
4.4 System earthing	19
5 Ratings	19
5.1 Standard values of rated frequency	19
5.2 Standard values of rated voltages	19
5.2.1 Rated voltage U_r for AC	19
5.2.2 Rated voltage U_r for DC	19
5.3 Standard values of rated voltage factor	20
5.3.1 Standard values of rated voltage factor for AC voltages	20
5.3.2 Standard values of rated voltage factor for DC voltages	21
6 Design requirements	21
6.1 Insulation requirements	21
6.2 Other insulation requirements	23
6.2.1 Low-voltage terminal not exposed to weather	23
6.2.2 Low-voltage terminal exposed to weather	23
6.2.3 Partial discharges	23
6.2.4 Chopped lightning impulse test	24
6.2.5 Capacitance at power frequency	25
6.2.6 Losses of the capacitor at power frequency	25
6.2.7 External insulation requirements	25
6.3 Electromagnetic emission requirements – Radio interference voltage (RIV)	26
6.4 Mechanical requirements	26
6.5 Tightness of equipment	27
6.5.1 General	27
6.5.2 Liquid tightness	27
6.5.3 Gas tightness	28

6.6	Voltage grading for DC capacitors.....	29
6.7	Requirements for temperature rise.....	30
6.8	Capacitor element ageing requirements	30
6.8.1	General	30
6.8.2	Capacitor element design criteria.....	30
6.9	Marking of the equipment.....	31
6.9.1	General	31
6.9.2	Markings of the rating plate	31
7	Tests	33
7.1	General.....	33
7.2	Classification of tests	33
7.2.1	General	33
7.2.2	Routine tests	34
7.2.3	Type tests.....	34
7.2.4	Special tests.....	35
7.2.5	Design tests	35
7.2.6	Routine test sequence	36
7.2.7	Type test sequence	37
7.3	Routine tests	38
7.3.1	General	38
7.3.2	Tightness of equipment	38
7.3.3	Capacitance and $\tan\delta$ measurement at power-frequency	38
7.3.4	Power-frequency or DC withstand test	39
7.3.5	Partial discharge measurement.....	41
7.3.6	Power-frequency voltage withstand test on low-voltage terminal if applicable	42
7.3.7	Resistance measurement for DC equipment	42
7.3.8	Verification of markings	42
7.3.9	Gas dew point measurement	42
7.4	Type tests	43
7.4.1	General	43
7.4.2	Impulse tests	43
7.4.3	Wet test for outdoor equipment.....	45
7.4.4	Radio interference voltage test	46
7.4.5	Polarity reversal test for DC equipment.....	47
7.4.6	Temperature rise test	48
7.4.7	Enclosure tightness test at ambient temperature.....	50
7.4.8	Mechanical tests.....	50
7.5	Special tests	51
7.5.1	Determination of the temperature coefficient of capacitance T_C	51
7.5.2	Enclosure tightness test at low and high temperatures.....	52
7.5.3	Internal arc test	53
7.5.4	Multiple chopped impulse test on primary terminals	53
7.5.5	Measurement of the impedance depending on frequency.....	53
7.5.6	Thermal stability test	54
7.5.7	Corrosion test.....	54
7.6	Design tests.....	55
7.6.1	Ageing test	55

8	Rules for transport, storage, erection, operation and maintenance.....	56
8.1	General.....	56
8.2	Conditions during transport, storage and installation	56
8.3	Installation	57
8.3.1	General	57
8.3.2	Unpacking and lifting	57
8.3.3	Assembly.....	57
8.3.4	Mounting	57
8.3.5	Connections	57
8.3.6	Final installation inspection and tests	57
8.4	Maintenance	58
8.4.1	General	58
8.4.2	Responsibilities for the manufacturer	58
9	Safety.....	58
10	Influence of products on the natural environment.....	59
	Annex A (informative) Typical diagram of an equipment.....	60
	Annex B (informative) Partial discharge test circuit and instrumentation.....	61
	Annex C (normative) Radio interference voltage – Measurement circuit.....	63
	Annex D (informative) Superimposed impulse voltage test.....	65
	D.1 Overview	65
	D.2 Test description	65
	D.3 Criteria to pass the test.....	66
	Annex E (informative) Test circuit for superimposed impulse voltage tests.....	67
	E.1 General.....	67
	E.2 Test circuit using blocking capacitor.....	67
	E.3 Test circuit using sphere gap	67
	Annex F (informative) High-frequency characteristic measurements	69
	Annex G (informative) Composite AC/DC voltages.....	70
	G.1 Composite AC/DC voltage descriptions	70
	G.2 Example 1 – without 3PWM	71
	G.3 Example 2 – with 3PWM	72
	G.4 Conclusion.....	74
	Annex H (informative) Voltage definitions	75
	Bibliography.....	76
	Figure 1 – Factor m for the switching impulse withstand test.....	18
	Figure 2 – Reduced scale model capacitor element geometry	31
	Figure 3 – Flow charts test sequence to be applied when performing the routine test.....	36
	Figure 4 – Flow charts test sequence to be applied when performing the type test.....	37
	Figure 5 – Test sequence for polarity reversal tests	48
	Figure 6 – Flow chart for temperature rise test.....	48
	Figure A.1 – Example of a diagram for a coupling capacitor (with and without low-voltage terminal).....	60
	Figure A.2 – Example of a diagram for a capacitor divider (with and without low-voltage terminal)	60
	Figure B.1 – Test circuit.....	61

Figure B.2 – Alternative circuit	61
Figure B.3 – Example of balanced test circuit	62
Figure B.4 – Example of calibration circuit	62
Figure C.1 – Measuring circuit	64
Figure D.1 – Schematic representation of superimposed impulse voltage tests	65
Figure E.1 – Test circuit for superimposed impulse tests using blocking capacitor	67
Figure E.2 – Test circuit for superimposed impulse tests using sphere gap	68
Figure F.1 – Wiring diagram of the measuring circuit for the high-frequency capacitance and equivalent series resistance of a coupling capacitor	69
Figure G.1 – Example of an unsymmetrically VSC converter	71
Figure G.2 – Maximum peak voltage without 3PWM	72
Figure G.3 – Both individual AC voltage curves with 3PWM	73
Figure G.4 – Superimposed voltage curve with 3PWM, based on Figure G.3	73
Figure H.1 – Voltage overview and definitions	75
Table 1 – Rated ambient temperature categories	16
Table 2 – Standard values of rated voltage factors	20
Table 3 – Standard insulation levels for AC voltages	21
Table 4 – Partial discharge test voltages and permissible levels	24
Table 5 – Creepage distance for AC	26
Table 6 – Static withstand test loads for insulators	27
Table 7 – Permissible temporary leakage rates for gas systems	29
Table 8 – Marking of the rating plate	32
Table 9 – List of Routine tests	34
Table 10 – List of Type tests	34
Table 11 – List of Special tests	35
Table 12 – List of Design tests	35
Table 13 – Test voltages for units, stacks and complete equipment	40
Table 14 – Modalities of application of the test loads to the line primary terminals	51
Table H.1 – Voltage definitions for DC application	75

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Coupling capacitors and capacitor dividers -
Part 1: General rules**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60358-1 has been prepared by IEC Technical Committee 33: Power capacitors and their applications. It is an International Standard.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

This edition of IEC 60358-1 includes the following significant technical changes with respect to the previous edition:

- a) new terms and definitions are presented in Clause 3;
- b) new definitions in Clause 4 and Clause 5;
- c) gas-insulated coupling capacitors and capacitor dividers are integrated in Clause 6;
- d) new tests in routine, type, special and design test sections are introduced, see Clause 7;
- e) new Clause 8, Clause 9 and Clause 10;