



IEC 60358-1

Edition 2.0 2025-12

# INTERNATIONAL STANDARD

REDLINE VERSION

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

iteh Standards  
(<https://standards.iteh.ai>)  
Document Preview

[IEC 60358-1:2025](https://standards.iteh.ai/catalog/standards/iec/231c82f0-f454-4ad0-93d1-1fba99e26764/iec-60358-1-2025)

<https://standards.iteh.ai/catalog/standards/iec/231c82f0-f454-4ad0-93d1-1fba99e26764/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.

IEC Secretariat  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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](http://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 It also gives information on projects, replaced and withdrawn publications.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](http://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](http://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](mailto:sales@iec.ch).

**IEC Products & Services Portal - [products.iec.ch](http://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](http://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.

[IEC 60358-1:2025](https://standards.iteh.ai/catalog/standards/iec/231c82f0-f454-4ad0-93d1-1fba99e26764/iec-60358-1-2025)

<https://standards.iteh.ai/catalog/standards/iec/231c82f0-f454-4ad0-93d1-1fba99e26764/iec-60358-1-2025>

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	9
2 Normative references .....	9
3 Terms, definitions, symbols and abbreviated terms.....	10
3.1 General.....	11
3.2 Coupling capacitor and capacitor divider specifics .....	14
4 <del>Service</del> Normal and special environmental conditions.....	17
4.1 General.....	17
4.2 Normal service conditions .....	17
4.2.1 Ambient air temperature .....	17
4.2.2 Altitude .....	17
4.2.3 Vibrations or earthquakes.....	17
4.2.4 Other service conditions for indoor equipment .....	17
4.2.5 Other service conditions for outdoor equipment .....	18
4.3 Special service conditions.....	18
4.3.1 General .....	18
4.3.2 Altitude .....	18
4.3.3 Ambient temperature .....	20
4.3.4 Earthquakes .....	21
4.4 System earthing.....	21
5 Ratings.....	21
5.1 Standard values of rated frequency.....	21
5.2 Standard values of rated voltages.....	21
5.2.1 Rated voltage $U_R$ $U_r$ for AC .....	21
5.2.2 Rated voltage $U_R$ $U_r$ for DC .....	22
5.3 Standard values of rated voltage factor .....	22
5.3.1 Standard values of rated voltage factor for AC voltages.....	22
5.3.2 Standard values of rated voltage factor for DC voltages .....	23
6 Design requirements.....	23
6.1 Insulation requirements.....	23
6.2 Other insulation requirements .....	28
6.2.1 Low-voltage terminal not exposed to weather .....	28
6.2.2 Low-voltage terminal exposed to weather .....	28
6.2.3 Partial discharges .....	28
6.2.4 Chopped lightning impulse test.....	29
6.2.5 Capacitance at power frequency.....	30
6.2.6 Losses of the capacitor at power frequency .....	30
6.2.7 External insulation requirements.....	30
6.3 Electromagnetic emission requirements – Radio interference voltage (RIV) .....	31
6.4 Mechanical requirements .....	31
6.5 Tightness of equipment.....	32
6.5.1 General .....	32
6.5.2 Liquid tightness .....	32
6.5.3 Gas tightness .....	33

6.6	Voltage grading for DC capacitors.....	34
6.7	Requirements for temperature rise.....	35
6.8	Capacitor element ageing requirements.....	35
6.8.1	General.....	35
6.8.2	Capacitor element design criteria.....	35
6.9	Marking of the equipment.....	36
6.9.1	General.....	36
6.9.2	Markings of the rating plate.....	36
7	Tests <del>conditions</del> .....	38
7.1	General.....	38
7.2	Classification of tests.....	38
7.2.1	General.....	38
7.2.2	Routine tests.....	39
7.2.3	Type tests.....	39
7.2.4	Special tests.....	40
7.2.5	Design tests.....	42
7.2.6	Routine test sequence.....	43
7.2.7	Type test sequence.....	44
7.3	Routine tests.....	45
7.3.1	General.....	45
7.3.2	Tightness of <del>the liquid-filled</del> equipment.....	45
<del>9.2</del>	<del>Electrical routine tests.....</del>	<del>45</del>
7.3.3	Capacitance and $\tan\delta$ measurement at power-frequency.....	45
7.3.4	Power-frequency or DC withstand test.....	47
7.3.5	Partial discharge measurement.....	49
7.3.6	<del>AC withstand test on low-voltage terminal of the equipment (6.2.1 and 6.2.2)</del> Power-frequency voltage withstand test on low-voltage terminal if applicable.....	49
7.3.7	Resistance measurement for DC equipment.....	50
7.3.8	Verification of markings.....	50
7.3.9	Gas dew point measurement.....	50
7.4	Type tests.....	50
7.4.1	General.....	50
7.4.2	Impulse tests.....	51
7.4.3	Wet test for outdoor equipment.....	53
7.4.4	Radio interference voltage test.....	54
7.4.5	<del>Voltage</del> Polarity reversal test for DC equipment.....	55
7.4.6	Temperature rise test.....	56
7.4.7	Enclosure tightness test at ambient temperature.....	58
7.4.8	<del>Special tests — Mechanical strength test</del> Mechanical tests.....	58
7.5	Special tests.....	60
7.5.1	Determination of the temperature coefficient of capacitance $T_C$ .....	60
7.5.2	Enclosure tightness test at low and high temperatures.....	61
7.5.3	Internal arc test.....	61
7.5.4	Multiple chopped impulse test on primary terminals.....	61
7.5.5	Measurement of the impedance depending on frequency.....	61
7.5.6	Thermal stability test.....	62
7.5.7	Corrosion test.....	62

7.6	Design tests.....	63
7.6.1	Ageing test.....	63
8	Rules for transport, storage, erection, operation and maintenance.....	64
8.1	General.....	64
8.2	Conditions during transport, storage and installation.....	64
8.3	Installation.....	65
8.3.1	General.....	65
8.3.2	Unpacking and lifting.....	65
8.3.3	Assembly.....	65
8.3.4	Mounting.....	65
8.3.5	Connections.....	65
8.3.6	Final installation inspection and tests.....	65
8.4	Maintenance.....	66
8.4.1	General.....	66
8.4.2	Responsibilities for the manufacturer.....	66
9	Safety.....	66
10	Influence of products on the natural environment.....	67
	Annex A (informative) Typical diagram of an equipment.....	68
	Annex B (informative) Partial discharge test circuit and instrumentation.....	70
	Annex C (normative) Radio interference voltage – Measurement circuit.....	72
	Annex D (informative) Superimposed impulse voltage test.....	74
D.1	Overview.....	74
D.2	Test description.....	74
D.3	Criteria to pass the test.....	75
	Annex E (informative) Test circuit for superimposed impulse voltage tests.....	76
E.1	General.....	76
E.2	Test circuit using blocking capacitor.....	76
E.3	Test circuit using sphere gap.....	76
	Annex F (informative) High-frequency characteristic measurements.....	78
	Annex G (informative) Composite AC/DC voltages.....	79
G.1	Composite AC/DC voltage descriptions.....	79
G.2	Example 1 – without 3PWM.....	80
G.3	Example 2 – with 3PWM.....	81
G.4	Conclusion.....	83
	Annex H (informative) Voltage definitions.....	84
	Bibliography.....	85
	<b>Figure 1 – Altitude correction factor for insulation.....</b>	
	Figure 1 – Factor $m$ for the switching impulse withstand test.....	20
	Figure 2 – Reduced scale model capacitor element geometry.....	36
	<b>Figure 2 – Flow charts test sequence to be applied when performing the type test (Figure 2a) and routine test (Figure 2b).....</b>	
	Figure 3 – Flow charts test sequence to be applied when performing the routine test.....	43
	Figure 4 – Flow charts test sequence to be applied when performing the type test.....	44
	Figure 5 – Test sequence for polarity reversal tests.....	56
	Figure 6 – Flow chart for temperature rise test.....	56

Figure A.1 – Example of a diagram for a coupling capacitor (with and without low-voltage terminal) .....	68
Figure A.2 – Example of a diagram for a capacitor divider (with and without low-voltage terminal) .....	69
Figure B.1 – Test circuit .....	70
Figure B.2 – Alternative circuit .....	70
Figure B.3 – Example of balanced test circuit .....	71
Figure B.4 – Example of calibration circuit .....	71
Figure C.1 – Measuring circuit .....	73
Figure D.1 – Schematic representation of superimposed impulse voltage tests .....	74
Figure E.1 – Test circuit for superimposed impulse tests using blocking capacitor .....	76
Figure E.2 – Test circuit for superimposed impulse tests using sphere gap .....	77
Figure F.1 – Wiring diagram of the measuring circuit for the high-frequency capacitance and equivalent series resistance of a coupling capacitor .....	78
Figure G.1 – Example of an unsymmetrically VSC converter .....	80
Figure G.2 – Maximum peak voltage without 3PWM .....	81
Figure G.3 – Both individual AC voltage curves with 3PWM .....	82
Figure G.4 – Superimposed voltage curve with 3PWM, based on Figure G.3 .....	82
Figure H.1 – Voltage overview and definitions .....	84
Table 1 – Rated ambient temperature categories .....	17
Table 2 – Standard values of rated voltage factors .....	23
Table 3 – Standard insulation levels for AC voltages .....	24
Table 4 – Partial discharge test voltages and permissible levels .....	28
Table 5 – Creepage distance for AC .....	31
Table 6 – Static withstand test loads for insulators .....	32
Table 7 – Permissible temporary leakage rates for gas systems .....	34
Table 8 – Marking of the rating plate .....	37
Table 9 – List of Routine tests .....	39
Table 10 – List of Type tests .....	40
Table 11 – List of Special tests .....	42
Table 12 – List of Design tests .....	42
Table 13 – Test voltages for units, stacks and complete equipment .....	48
Table 14 – Modalities of application of the test loads to the line primary terminals .....	59
Table H.1 – Voltage definitions for DC application .....	84

## 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.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60358-1:2012. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.