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REDLINE VERSION

~~Grading~~ Capacitors for high-voltage alternating current circuit-breakers - Part 1: General and grading capacitors

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62146-1:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62146-1 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 2016. This edition constitutes a technical revision.

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

a) Clause re-ordering and reworked sentences;

b) New type and special tests.

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

Draft	Report on voting
33/746/FDIS	33/750/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62146 series, published under the general title *Capacitors for high-voltage alternating current circuit-breakers*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

1 Scope

This part of IEC 62146 ~~is applicable to grading~~ includes generalities of capacitors used on alternating current circuit-breakers and introduces specifications for grading capacitors. Regarding grading capacitors, their function is to control the voltage distribution across the individual interrupter units of a multi-break circuit-breaker.

~~Grading~~ Capacitors can also be used in parallel to the interrupter unit on single break circuit-breakers to modify the Transient Recovery Voltage (TRV). This TRV capacitor application is covered by IEC 62146-2:2023.

~~The grading capacitor is a sub-component for the circuit-breaker and shall be specified in accordance with the circuit-breaker specifications.~~

Capacitors for high-voltage alternating circuit breakers are sub-components for the circuit-breaker and are specified in accordance with the circuit-breaker specifications according to IEC 62271-1, IEC 62271-100, and if applicable to IEC 62271-203.

This document applies to grading capacitors falling into one or both of the following categories for:

– mounting on air-insulated circuit-breakers.

– mounting on enclosed circuit-breakers (for example immersed in ~~SF_6~~ insulating gas, in oil, etc.).

The testing for each of the above applications is in some cases different.

The object of this document is:

– to define uniform rules regarding performances, testing and rating;

– to define specific safety rules;

– to provide a guidance for installation and operation.

NOTE CIGRÉ TB-368 presents a study about the operating environment of voltage grading capacitors applied to high-voltage circuit-breakers (see [2][1]).

This document does not apply to ~~phase-to-earth capacitors installed on the circuit-breaker to modify the Transient Recovery Voltage~~ capacitors not directly associated with high-voltage alternating current circuit-breakers.

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 (all parts), *International electrotechnical vocabulary* (available at http://www.electropedia.org)~~

IEC 60060-1~~:2010~~, *High-voltage test techniques - Part 1: General terminology and test requirements*

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1 Numbers in square brackets refer to the Bibliography.

IEC 60068-2-17:~~1994~~2023, ~~*Official version in Russian – Basic*~~ *Environmental testing ~~procedures~~ - Part 2-17: Tests - Test Q: Sealing*

~~IEC 60071-1:2006, *Insulation co-ordination – Part 1: Definitions, principles and* rules~~

IEC 60071-2:2023, *Insulation co-ordination - Part 2: Application guidelines*

IEC 60270:~~2000~~2025, *High-voltage test techniques - Charge-based measurement of partial discharge~~s measurements~~*

IEC 60296, *Fluids for electrotechnical applications - Mineral insulating oils for electrical equipment*

~~IEC 60376:2005, *Specification of technical grade sulfur hexafluoride (SF_6) for use in electrical equipment*~~

~~IEC 60507-1:1991, *Artificial pollution tests on high-voltage insulators to be used on a.c. systems*~~

IEC 60567~~:2011~~, *Oil-filled electrical equipment - Sampling of gases and analysis of free and dissolved gases in mineral oils and other insulating liquids - Guidance*

~~IEC 60721-1:2002, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*~~

IEC 60815 (all parts), *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions*

IEC 60867, *Insulating liquids - Specifications for unused liquids based on synthetic aromatic hydrocarbons*

IEC 61099, *Insulating liquids - Specifications for unused synthetic organic esters for electrical purposes*

IEC 61462~~:2007~~, *Composite hollow insulators - Pressurized and unpressurized insulators for use in electrical equipment with AC rated voltage greater than 1 000 V AC and DC voltage greater than 1 500 V – Definitions, test methods, acceptance criteria and design recommendations*

IEC 62146-2:2023, *Capacitors for high-voltage alternating current circuit-breakers - Part 2: TRV capacitors*

IEC 62155:2003, *Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*

IEC 62271-1~~:2007~~, *High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-100~~:2008~~, *High-voltage switchgear and controlgear - Part 100: Alternating-current circuit-breakers*

IEC 62271-203~~:2003~~, *High-voltage switchgear and controlgear - Part 203: AC gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

IEC 62271-205, *High-voltage switchgear and controlgear - Part 205: Compact switchgear assemblies for rated voltages above 52 kV*

IEC 62271-300~~:2006~~, *High-voltage switchgear and controlgear - Part 300: Seismic qualification of alternating current circuit-breakers*

IEC 62770, *Fluids for electrotechnical applications - Unused natural esters for transformers and similar electrical equipment*

IEC 63012, *Insulating liquids - Unused modified or blended esters for electrotechnical applications*

~~IEC Guide 109, *Environmental aspects – Inclusion in electrotechnical product standards*~~

~~CISPR 18-2:1986, *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits*~~

Bibliography

[1] GARTON, C.G., *Dielectric loss in thin films of insulating liquids, Journal of the Institution of Electrical Engineers - Part II: Power Engineering*, March 1941, Vol. 88, Issue 1, pp. 23-40

[2] CIGRÉ TB-368, *Operating environment of voltage grading capacitors applied to high voltage circuit-breakers*, Working group A3.18, Technical Brochure No. 368, February 2009

[3] IEC 60068-2-11, *Environmental testing - Part 2-11: Tests - Test Ka: Salt mist*

[4] IEC 60068-2-42, *Environmental testing - Part 2-42: Tests - Test Kc: Sulphur dioxide test for contacts and connections*

[5] IEC 60721-3-2, *Classification of environmental conditions - Part 3-2: Classification of groups of environmental parameters and their severities - Transportation and Handling*

[6] IEC Guide 109, *Environmental aspects - Inclusion in electrotechnical product standards*

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