

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Shunt power capacitors of the self-healing type for AC systems having a rated voltage above 1 000 V

(standards.iteh.ai)

Condensateurs-shunt de puissance autorégénérateurs destinés aux réseaux à courant alternatif de tension assignée supérieure à 1 000 V

<https://standards.iteh.ai/catalog/standards/sis/4866cd67-2087-4428-981f-5bf5136bb6f9/iec-63210-2021>



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SHUNT POWER CAPACITORS OF THE SELF-HEALING TYPE FOR AC SYSTEMS HAVING A RATED VOLTAGE ABOVE 1 000 V

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

Draft	Report on voting
33/651/FDIS	33/653/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/standardsdev/publications.

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SHUNT POWER CAPACITORS OF THE SELF-HEALING TYPE FOR AC SYSTEMS HAVING A RATED VOLTAGE ABOVE 1 000 V

1 Scope

This document is applicable to both self-healing capacitor units and self-healing capacitor banks intended to be used, particularly, for power-factor correction of AC power systems having a rated voltage above 1 000 V and fundamental frequencies of 15 Hz to 60 Hz.

The following capacitors are excluded from this document:

- shunt power capacitors of the self-healing type for AC systems having a rated voltage up to and including 1 000 V (IEC 60831-1, -2);
- shunt power capacitors of the non-self-healing type for AC systems having a rated voltage up to and including 1 000 V (IEC 60931-1, -2 and -3);
- shunt capacitors of the non-self-healing type for AC power systems having a rated voltage above 1 000 V (IEC 60871-1, -2, -3 and -4);
- capacitors for inductive heat-generating plants operating at frequencies between 40 Hz and 24 000 Hz (IEC 60110-1 and -2);
- series capacitors (IEC 60143-1, -2, -3 and -4);
- AC motor capacitors (IEC 60252-1 and -2);
- coupling capacitors and capacitor dividers (IEC 60358-1, -2, -3, -4);
- capacitors for power electronic circuits (IEC 61071);
- small AC capacitors to be used for fluorescent and discharge lamps (IEC 61048 and IEC 61049);
- capacitors for suppression of radio interference;
- capacitors intended to be used in various types of electrical equipment, and thus considered as components;
- capacitors intended for use with DC voltage superimposed on the AC voltage.

Requirements for accessories such as insulators, switches, instrument transformers and external fuses are given in the relevant IEC standards and are not covered by the scope of this document.

The object of this document is to:

- a) formulate uniform rules regarding performances, testing and rating;
- b) formulate specific safety rules;
- c) provide a guide for installation and operation.

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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60071-2:1996, *Insulation co-ordination – Part 2: Application guide* ¹

IEC 60549, *High-voltage fuses for the external protection of shunt capacitors*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

capacitor element element

device consisting essentially of two electrodes separated by a dielectric

[SOURCE: IEC 60050-436:1990, 436-01-03]

3.2

capacitor unit

assembly of one or more capacitor elements in the same container with terminals brought out

[SOURCE: IEC 60050-436:1990, 436-01-04]

3.3

capacitor bank bank

number of capacitor units connected so as to act together

[SOURCE: IEC 60050-436:1990, 436-01-06]

3.4

capacitor

two-terminal device characterized essentially by its capacitance

Note 1 to entry: The term "capacitor" is used when it is not necessary to specify whether a capacitor unit or capacitor bank is meant.

[SOURCE: IEC 60050-151:2001, 151-13-28, modified – Note 1 to entry has been added.]

3.5

self-healing capacitor self-healing metallized dielectric capacitor

capacitor (consisting of elements which have at least one electrode made of a metallic deposit on the dielectric) whose electrical properties, after local breakdown of the dielectric, are rapidly and essentially restored

[SOURCE: IEC 60050-436:1990, 436-03-12, modified – addition of "(metallized dielectric)" and "(consisting of elements whose at least one electrode is made of a metallic deposit on the dielectric)"]

¹ Withdrawn. IEC 60071-2:1996 has been cancelled and replaced by IEC 60071-2:2018.

3.6 capacitor installation

one or more capacitor banks and their accessories

[SOURCE: IEC 60050-436:1990, 436-01-07]

3.7 discharge device of a capacitor

device which may be incorporated in a capacitor, capable of reducing the voltage between the terminals practically to zero, within a given time, after the capacitor has been disconnected from a network

[SOURCE: IEC 60050-436:1990, 436-03-15, modified – In the definition, "intended to reduce" has been replaced by "capable of reducing" and "to a given value" has been replaced by "practically to zero".]

3.8 Safety device (of a capacitor unit)

3.8.1

overpressure disconnecter

disconnecting device designed to switch off the capacitor unit in case of abnormal increase of the internal pressure

[SOURCE: IEC 60050-436:1990, 436-03-17, modified – "for a capacitor" has been deleted from the term. In the definition, "to interrupt the current path in the event" has been replaced by "to switch off the capacitor unit in case".]

3.8.2

overpressure detector

device designed to detect abnormal increase of the internal pressure of the capacitor unit, usually used to operate an electrical switch and indirectly interrupt the current path of the capacitor unit

3.8.3

overtemperature disconnecter

disconnecting device designed to switch off the capacitor unit in case of abnormal increase of the internal temperature

3.8.4

segmented metallization design

pattern design of the metal layer over the dielectric shaped in a way to allow a small part of it to be isolated in case of local short-circuit or breakdown, in order to restore the full functionality of the unit with a negligible loss of capacitance

3.8.5

special unsegmented metallization design

design of the metal layer over the dielectric shaped in a way that safe self-healing features operating at a voltage up to U_N guarantee the full functionality of the unit with a negligible loss of capacitance

3.8.6

fault detector

device with other safety mechanisms (design measures, sensors or provisions) than those defined in 3.8.1 to 3.8.5 but utilized with the same purpose to detect an abnormal technical state of the capacitor unit in order to avoid possible safety risks by indirect interruption of the current path in the capacitor unit

3.9 Protection (of a capacitor unit)

3.9.1

protected capacitor unit

capacitor unit that meets the requirements for the destruction test as specified in Clause 19

Note 1 to entry: Protected capacitors alone are not sufficient to prevent all possible dangers in case of malfunction.

3.9.2

unprotected capacitor unit

capacitor unit that does not meet requirements for the destruction test as specified in Clause 19

3.10

line terminal

terminal intended for connection to a line conductor of a network

Note 1 to entry: In polyphase capacitors, a terminal intended to be connected to the neutral conductor is not considered to be a line terminal.

[SOURCE: IEC 60050-436:1990, 436-03-01, modified – Note 1 to entry has been added.]

3.11

rated capacitance of a capacitor

C_N

capacitance value derived from the values of rated output, voltage and frequency of the capacitor

[SOURCE: IEC 60050-436:1990, 436-01-12, modified – The symbol " C_N " has been added.]

3.12

rated output of a capacitor

rated power of a capacitor

Q_N

reactive power for which the capacitor has been designed

[SOURCE: IEC 60050-436:1990, 436-01-16, modified – In the term, "(power)" has been added, and the symbol " Q_N " has been added.]

3.13

rated voltage of a capacitor

U_N

RMS value of the alternating voltage for which the capacitor has been designed

Note 1 to entry: In the case of capacitors consisting of one or more separate circuits (for example single-phase units intended for use in polyphase connection, or polyphase units with separate circuits), U_N refers to the rated voltage of each circuit.

For polyphase capacitors with internal electrical connections between the phases, and for polyphase capacitor banks, U_N refers to the phase-to-phase voltage.

[SOURCE: IEC 60050-436:1990, 436-01-15, modified – The symbol " U_N " and Note 1 to entry have been added.]

3.14

rated frequency of a capacitor

f_N

frequency for which the capacitor has been designed

[SOURCE: IEC 60050-436:1990, 436-01-14, modified – The symbol " f_N " has been added.]

3.15 rated current of a capacitor

 I_N

RMS value of the alternating current for which the capacitor has been designed

[SOURCE: IEC 60050-436:1990, 436-01-13, modified – The symbol " I_N " has been added.]

3.16 total capacitor losses

active power dissipated in the capacitor

Note 1 to entry: All loss-producing components are included, for example:

- for a unit, losses from dielectric, internal fuses, internal discharge resistor, connections, etc;
- for a bank, losses from units, external fuses, busbars, discharge and damping reactors, etc.

Note 2 to entry: The capacitor losses may be recalculated as an equivalent series resistor to the unit and/or bank.

[SOURCE: IEC 60050-436:1990, 436-04-10, modified – In the term, "total" has been added. Note 1 and Note 2 to entry have been added.]

3.17 loss factor of a capacitor

tangent of the loss angle (of a capacitor)

 $\tan \delta$

ratio between the equivalent series resistance and the capacitive reactance of the capacitor at specified sinusoidal alternating voltage and frequency

[SOURCE: IEC 60050-436:1990, 436-04-11, modified. The term "loss factor of a capacitor" has been added.]

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3.18 maximum permissible AC voltage of a capacitor

maximum RMS alternating voltage which the capacitor can sustain for a given time in specified conditions

[SOURCE: IEC 60050-436:1990, 436-04-07]

3.19 maximum permissible AC current of a capacitor

maximum RMS alternating current which the capacitor can sustain for a given time in specified conditions

[SOURCE: IEC 60050-436:1990, 436-04-09]

3.20 ambient air temperature

temperature of the air at the proposed location of the capacitor

3.21 cooling air temperature

temperature of the cooling air measured at the hottest position in the bank, under steady-state conditions, midway between two units

Note 1 to entry: If only one unit is involved, it is the temperature measured at a point approximately 0,1 m away from the capacitor container and at two-thirds of the height from its base considering its mounting orientation.

3.22**steady-state condition**

thermal equilibrium attained by the capacitor at constant output and at constant ambient air temperature

3.23**residual voltage**

voltage remaining on the terminals of a capacitor at a certain time following disconnection

3.24**test voltage**

U_t

voltage to be applied for designated test, which is identified either as AC or DC in the according description of test

3.25**external fuse**

fuse connected outside the capacitor unit(s) and mounted electrically in series with one unit or one group of parallel units

4 Service conditions**4.1 Normal service conditions**

This document gives requirements for capacitors intended for use under the following conditions:

a) Residual voltage at energization

Not exceeding 10 % rated voltage. [IEC 63210:2021](#)

b) Altitude <https://standards.iteh.ai/catalog/standards/sist/4bb6cdb7-2087-4428-981f-5bf5136bb6f9/iec-63210-2021>

Not exceeding 1 000 m.

In case of installations on altitudes above 1 000 m, correction factors for insulation (clearance) and correction factors for power reduction (thermal stability) shall be considered.

c) Ambient air temperature categories

Capacitors are classified in temperature categories, each category being specified by a number followed by a letter. The number represents the lowest ambient air temperature at which the capacitor may operate.

The letters represent upper limits of temperature variation ranges, having maximum values specified in Table 1. The temperature categories cover the temperature range of -50 °C to $+55\text{ °C}$.

The lowest ambient air temperature at which the capacitor may be operated should be chosen from the five preferred values $+5\text{ °C}$, -5 °C , -25 °C , -40 °C , -50 °C .

For indoor use, a lower limit of -5 °C is normally applicable.

Table 1 is based on service conditions in which the capacitor does not influence the ambient air temperature (for example outdoor installations).