

Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1kV —

Part 1: General — Performance, testing and rating — Safety requirements — Guide for installation and operation

The European Standard EN 60831-1:1996, with the incorporation of amendment A1:2003 has the status of a British Standard

ICS 29.120.99; 31.060.70

National foreword

This British Standard is the English language version of EN 60831-1:1996, including amendment A1:2003. It is identical with IEC 60831-1:1996, Edition 2.1:2002 which comprises Edition 2:1996 consolidated by the incorporation of amendment 1:2002. It supersedes BS EN 60831-1:1994 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/33, Power capacitors, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

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This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 May 1998

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(includes amendment A1:2003)
(IEC 831-1:1996 + A1:2002)

Condensateurs shunt de puissance
autorégénérateurs pour réseaux à courant alternatif
de tension assignée inférieure ou égale à 1 kV —
Partie 1: Généralités — Caractéristiques
fonctionnelles, essais et valeurs assignées —
Règles de sécurité — Guide d'installation et
d'exploitation
(inclut l'amendement A1:2003)
(CEI 831-1:1996 + A1:2002)

Selbstheilende Leistungs-Parallelkondensatoren für
Wechselstromanlagen mit einer Nennspannung
bis 1 kV —
Teil 1: Allgemeines Leistungsanforderungen,
Prüfung und Bemessung —
Sicherheitsanforderungen Anleitung für Errichtung
und Betrieb
(enthält Änderung A1:2003)
(IEC 831-1:1996 + A1:2002)

This European Standard was approved by CENELEC on 1996-10-01; amendment A1 was approved by CENELEC on 2003-02-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of documents 33/234/FDIS and 33/234A/FDIS, future edition 2 of IEC 831-1, prepared by IEC TC 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 831-1 on 1996-10-01.

This European Standard supersedes EN 60831-1:1993.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-08-01

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex A and Annex ZA are normative and Annex B is informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 831-1:1996 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 33/376/FDIS, future amendment 1 to IEC 60831-1:1996, prepared by IEC TC 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60831-1:1996 on 2003-02-01.

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Endorsement notice

The text of amendment 1:2002 to the International Standard IEC 60831-1:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

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SHUNT POWER CAPACITORS OF THE SELF-HEALING TYPE FOR A.C. SYSTEMS HAVING A RATED VOLTAGE UP TO AND INCLUDING 1000 V –

Part 1: General – Performance, testing and rating – Safety requirements – Guide for installation and operation

Section 1: General

1 Scope and object

This part of IEC 60831 is applicable to both capacitor units and capacitor banks intended to be used, particularly, for power-factor correction of a.c. power systems having a rated voltage up to and including 1000 V and frequencies 15 Hz to 60 Hz.

This part of IEC 60831 also applies to capacitors intended for use in power filter circuits. Additional definitions, requirements, and tests for filter capacitors are given in annex A.

The following capacitors are excluded from this part of IEC 60831:

- Shunt power capacitors of the non-self-healing type for a.c. systems having a rated voltage up to and including 1000 V (IEC 60931).
- Shunt capacitors for a.c. power systems having a rated voltage above 1000 V (IEC 60871).
- Capacitors for inductive heat-generating plants operating at frequencies between 40 Hz and 24 000 Hz (IEC 60110).
- Series capacitors (IEC 60143).
- Capacitors for motor applications and the like (IEC 60252).
- Coupling capacitors and capacitor dividers (IEC 60358).
- Capacitors to be used in power electronic circuits (IEC 61071).
- Small a.c. capacitors to be used for fluorescent and discharge lamps (IEC 61048 and IEC 61049).
- Capacitors for suppression of radio interference (under consideration).
- Capacitors intended to be used in various types of electrical equipment, and thus considered as components.
- Capacitors intended for use with d.c. voltage superimposed on the a.c. voltage.

Accessories such as insulators, switches, instrument transformers, fuses, etc., should be in accordance with the relevant IEC standards.

The object of this part of IEC 60831 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 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 60050(436):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 436: Power capacitors*

IEC 60060-1:1989, *High voltage test techniques – Part 1: General definitions and test requirements*

IEC 60110:1973, *Recommendation for capacitors for inductive heat generating plants operating at frequencies between 40 and 24 000 Hz*

IEC 60143:1992, *Series capacitors for power systems*

IEC 60252:1993, *A.C. motor capacitors*

IEC 60269-1:1986, *Low-voltage fuses – Part 1: General requirements*

IEC 60358:1990, *Coupling capacitors and capacitor dividers*

IEC 60831-2:1995, *Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1000 V – Part 2: Ageing test, self-healing test and destruction test*

IEC 60871-1:1987, *Shunt capacitors for a.c. power systems having a rated voltage above 1000 V* – Part 1: General – Performance, testing and rating – Safety requirements – Guide for installation and operation*

IEC 60931-1:1996, *Shunt power capacitors of the non-self-healing type for a.c. systems having a rated voltage up to and including 1000 V – Part 1: General – Performance, testing and rating – Safety requirements – Guide for installation and operation*

IEC 60931-3:1996, *Shunt power capacitors of the non-self-healing type for a.c. systems having a rated voltage up to and including 1000 V – Part 3: Internal fuses*

IEC 61000-2-2:1990, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 2: Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

* According to Amendment 1 (1991).

IEC 61000-4-1:1992, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 1: Overview of immunity tests*. Basic EMC publication

IEC 61048:1991, *Capacitors for use in tubular fluorescent and other discharge lamp circuits – General and safety requirements*

IEC 61049:1991, *Capacitors for use in tubular fluorescent and other discharge lamp circuits – Performance requirements*

IEC 61071-1:1993, *Power electronic capacitors – Part 1: General*

3 Definitions

For the purposes of this part of IEC 60831, the following definitions apply:

3.1

capacitor element (or element)

a device consisting essentially of two electrodes separated by a dielectric

[IEV 436-01-03]

3.2

capacitor unit (or unit)

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

[IEV 436-01-04]

3.3

self-healing capacitor

a capacitor of which the electrical properties, after local breakdown of the dielectric, are rapidly and essentially restored

[IEV 436-03-12]

3.4

capacitor bank (or bank)

a number of capacitor units connected so as to act together

[IEV 436-01-06]

3.5

capacitor

in this part of IEC 60831, the word capacitor is used when it is not necessary to lay particular stress upon the different meanings of the words capacitor unit or capacitor bank

3.6

capacitor installation

one or more capacitor banks and their accessories

[IEV 436-01-07]

3.7**discharge device of a capacitor**

a 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

[IEV 436 03-15 modified]

3.8**internal fuse of a capacitor**

a fuse connected inside a capacitor unit, in series with an element or a group of elements

[IEV 436-03-16]

3.9**overpressure disconnecter for a capacitor**

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

[IEV 436-03-17 modified]

3.10**overtemperature disconnecter for a capacitor**

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

3.11**line terminal**

a terminal intended for connection to a line conductor of a network

[IEV 436-03-01]

NOTE In polyphase capacitors, a terminal intended to be connected to the neutral conductor is not considered to be a line terminal.

3.12**rated capacitance of a capacitor (C_N)**

the capacitance value for which the capacitor has been designed

[IEV 436-01-12 modified]

3.13**rated output of a capacitor (Q_N)**

the reactive power derived from the rated values of capacitance, frequency and voltage

[IEV 436-01-16 modified]

3.14**rated voltage of a capacitor (U_N)**

the r.m.s. value of the alternating voltage for which the capacitor has been designed

[IEV 436-01-15]

NOTE In the case of capacitors consisting of one or more separate circuits (such as 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.

3.15

rated frequency of a capacitor (f_N)

the frequency for which the capacitor has been designed

[IEV 436-01-14]

3.16

rated current of a capacitor (I_N)

the r.m.s. value of the alternating current for which the capacitor has been designed

[IEV 436-01-13]

3.17

capacitor losses

the active power dissipated in the capacitor

[IEV 436-04-10]

NOTE All loss-producing components should be 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.

3.18

tangent of the loss angle ($\tan \delta$) of a capacitor

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

[IEV 436-04-11]

3.19

maximum permissible a.c. voltage of a capacitor

the maximum r.m.s. alternating voltage which the capacitor can sustain for a given time in specified conditions

[IEV 436-04-07]

3.20

maximum permissible a.c. current of a capacitor

the maximum r.m.s. alternating current which the capacitor can sustain for a given time in specified conditions

[IEV 436-04-09]

3.21

ambient air temperature

the temperature of the air at the proposed location of the capacitor

3.22

cooling air temperature

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

3.23

steady-state condition

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

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

4 Service conditions

4.1 Normal service conditions

This standard gives requirements for capacitors intended for use in the following conditions:

- a) *Residual voltage at energization*
Not to exceed 10 % rated voltage (clause 22, clause 32, and annex B).
- b) *Altitude*
Not exceeding 2000 m.
- 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 °C.

The lowest ambient air temperature at which the capacitor may be operated should be chosen from the five preferred values +5 °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).

Table 1 – Letter symbols for upper limit of temperature range

Symbol	Ambient temperature °C		
	Maximum	Highest mean over any period of	
		24 h	1 year
A	40	30	20
B	45	35	25
C	50	40	30
D	55	45	35

NOTE 1 The temperature values according to table 1 can be found in the meteorological temperature table covering the installation site.

NOTE 2 Higher temperature values than those indicated in table 1 can be considered in special applications by mutual agreement between manufacturer and purchaser. In that case, the temperature category should be indicated by the combination of minimum and maximum temperature values, for example, –40/60.