

AC motor capacitors —

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

The European Standard EN 60252-1:2001 has the status of a
British Standard

ICS 31.060.70

National foreword

This British Standard is the official English language version of EN 60252-1:2001. It is identical with IEC 60252-1:2001. It supersedes BS EN 60252:1994 which will be withdrawn on 2004-10-01.

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

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Part 1: General - Performance, testing and rating -
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Condensateurs des moteurs à courant
alternatif
Partie 1: Généralités -
Caractéristiques fonctionnelles,
essais et valeurs assignées -
Règles de sécurité -
Guide d'installation et d'utilisation
(CEI 60252-1:2001)

Motorkondensatoren
Teil 1: Allgemeines -
Leistung, Prüfung und Bemessung -
Sicherheitsanforderungen -
Leitfaden für die Installation und
den Betrieb
(IEC 60252-1:2001)

This European Standard was approved by CENELEC on 2001-09-25. 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.

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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 document 33/333/FDIS, future edition 1 of IEC 60252-1, prepared by IEC TC 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60252-1 on 2001-09-25.

This European Standard supersedes EN 60252:1994 + corrigendum May 1994.

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) 2002-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2004-10-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annexes A and ZA are normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60252-1:2001 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60110-1	NOTE	Harmonized as EN 60110-1:1998 (not modified).
IEC 60143	NOTE	Harmonized in the series EN 60143 (modified).
IEC 60358	NOTE	Harmonized as HD 597 S1:1992 (not modified).
IEC 60831-1	NOTE	Harmonized as EN 60831-1:1996 (not modified).
IEC 60871-1	NOTE	Harmonized as EN 60871-1:1997 (not modified).
IEC 60931-1	NOTE	Harmonized as EN 60931-1:1996 (not modified).
IEC 61048	NOTE	Harmonized as EN 61048:1993 (not modified).
IEC 61071-1	NOTE	Harmonized as EN 61071-1:1996 (modified).

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

1 General

1.1 Scope and object

This International Standard applies to motor capacitors intended for connection to windings of asynchronous motors supplied from a single-phase system having a frequency up to and including 100 Hz, and to capacitors to be connected to three-phase asynchronous motors so that these motors may be supplied from a single-phase system.

This standard covers impregnated or unimpregnated capacitors having a dielectric of paper, plastic film, or a combination of both, either metallized or with metal-foil electrodes, with rated voltages up to and including 660 V.

Motor start capacitors will be covered by IEC 60252-2*.

NOTE The following are excluded from this standard:

- shunt capacitors of the self-healing type for a.c. power systems of up to and including 1 000 V nominal voltage (see IEC 60831-1);
- shunt capacitors of non-self-healing type for a.c. power systems of up to and including 1 000 V nominal voltage (see IEC 60931-1);
- shunt capacitors for a.c. power systems having a nominal voltage above 1 000 V (see IEC 60871-1);
- capacitors for induction heat-generating plants, operating at frequencies between 40 Hz and 24 000 Hz (see IEC 60110-1);
- series capacitors (see IEC 60143);
- coupling capacitors and capacitor dividers (see IEC 60358);
- capacitors to be used in power electronic circuits (see IEC 61071-1);
- small a.c. capacitors to be used for fluorescent and discharge lamps (see IEC 61048);
- capacitors for suppression of radio interference (IEC publication 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 a.c. voltage.

The object of this standard is

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

* *AC motor capacitors – Part 2: Motor start capacitors.* In preparation. This will become the standard for both self-healing and electrolytic motor start capacitors.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60252. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60252 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068-2-3:1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60309-1:1999, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-2-1/0:1994, *Fire hazard testing – Part 2: Test methods – Section 1/sheet 0: Glow-wire test methods – General*

IEC 60695-2-1/1:1994, *Fire hazard testing – Part 2: Test methods – Section 1/sheet 1: Glow-wire end-product test and guidance*

ISO 4046:1978, *Paper, board, pulp and related terms – Vocabulary*

1.3 Definitions

For the purpose of this part of IEC 60252, the following definitions apply.

1.3.1

motor running capacitor

a power capacitor which, when used in conjunction with an auxiliary winding of a motor, assists the motor to start and improves the torque under running conditions

NOTE The running capacitor is usually connected permanently to the motor winding and remains in circuit throughout the running period of the motor. During the starting period, if it is in parallel with the starting capacitor, it helps to start the motor.

1.3.2

motor starting capacitor

a power capacitor which provides a leading current to an auxiliary winding of a motor and which is switched out of circuit once the motor is running

1.3.3

metal foil capacitor

a capacitor, the electrodes of which consist of metal foils or strips separated by a dielectric

1.3.4

metallized capacitor

a capacitor, in which the electrodes consist of a metallic deposit on the dielectric

1.3.5

self-healing capacitor

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

1.3.6

discharge device of a capacitor

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

1.3.7

continuous operation

operation with no time limit within the normal life of the capacitor

1.3.8

class of operation

the minimum total life for which the capacitor has been designed at rated duty, voltage, temperature and frequency

Class A – 30 000 h

Class B – 10 000 h

Class C – 3 000 h

Class D – 1 000 h

These classes of operation are intended to represent a true failure rate not exceeding 3 % during the life of the product.

A capacitor may have more than one class with corresponding voltages.

1.3.9

minimum permissible capacitor operating temperature

minimum permissible temperature on the outside of the case at the moment of switching on the capacitor

1.3.10

maximum permissible capacitor operating temperature (t_c)

maximum permissible temperature of the hottest area of the outside of the capacitor case during operation

1.3.11

rated voltage of a capacitor (U_N)

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

1.3.12

rated frequency of a capacitor (f_N)

highest frequency for which the capacitor has been designed

1.3.13

rated capacitance of a capacitor (C_N)

capacitance value for which the capacitor has been designed

1.3.144

rated current of a capacitor (I_N)

r.m.s. value of the alternating current at the rated voltage and frequency

1.3.15

rated output of a capacitor (Q_N)

reactive power derived from the rated values of capacitance, frequency and voltage (or current)

1.3.16

capacitor losses

active power dissipated by a capacitor

NOTE Unless otherwise stated, the capacitor losses will be understood to include losses in fuses and discharge resistors forming an integral part of the capacitor.

1.3.17

tangent of loss angle (tan delta) of a capacitor

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

1.3.18

capacitive leakage current (only for capacitors with a metal case)

current flowing through a conductor connecting the metallic case to earth, when the capacitor is energized from an a.c. supply system with an earthed neutral

1.3.19

type of capacitor

capacitors are considered to be of the same type when of similar constructional form, the same constructional technology, same rated voltage, same climatic category and same kind of operation. Capacitors of the same type can differ only in rated capacitance and size. Minor differences between terminations and mounting devices are permitted

NOTE The same construction includes, for example, the same dielectric material, dielectric thickness and type of case (metal or plastic).

1.3.20

model of capacitor

capacitors are considered to be of the same model when they are of the same construction and have the same functional and dimensional characteristics within the tolerance limits and are consequently interchangeable

1.3.21

class of safety protection

degree of safety protection identified by one of three codes to be marked on the capacitor

- (P2) indicates that the capacitor type has been designed to fail in the open-circuit mode only and is protected against fire or shock hazard. Compliance is verified by the test described in 2.16.
- (P1) indicates that the capacitor type may fail in the open-circuit or short-circuit mode and is protected against fire or shock hazard. Compliance is verified by the test described in 2.16.
- (P0) indicates that the capacitor type has no specific failure protection.

1.4 Service conditions

1.4.1 Normal service conditions

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

- a) altitude: not exceeding 2 000 m;
- b) residual voltage at energization: shall not exceed 10 % rated voltage (see 4.4, note);
- c) pollution: capacitors included in the scope of this standard are designed for operation in lightly polluted atmospheres;

NOTE The IEC has not yet established a definition for "lightly polluted". When this definition is established by the IEC, it will be incorporated in this standard.

- d) operating temperature: between $-40\text{ }^{\circ}\text{C}$ and $+100\text{ }^{\circ}\text{C}$ (see 1.3.9 and 1.3.10).

The preferred minimum and maximum permissible capacitor operating temperatures are as follows:

- minimum temperatures: $-40\text{ }^{\circ}\text{C}$, $-25\text{ }^{\circ}\text{C}$, $-10\text{ }^{\circ}\text{C}$ and $0\text{ }^{\circ}\text{C}$;
- maximum temperatures: $55\text{ }^{\circ}\text{C}$, $70\text{ }^{\circ}\text{C}$, $85\text{ }^{\circ}\text{C}$ and $100\text{ }^{\circ}\text{C}$.

Capacitors shall be suitable for transport and storage at temperatures down to $-25\text{ }^{\circ}\text{C}$, or the minimum operating temperature, whichever is the lower, without adverse effect on their quality;

- e) damp heat severity: between 4 days and 56 days. The preferred severity is 21 days.

(The damp heat severity shall be selected from the values indicated by IEC 60068-2-3, i.e.: 4 days, 10 days, 21 days and 56 days.)

Capacitors are classified in climatic categories defined by the minimum and maximum permissible capacitor operating temperatures and damp heat severity; i.e. 10/70/21 indicates that the minimum and the maximum permissible capacitor operating temperatures are $-10\text{ }^{\circ}\text{C}$ and $70\text{ }^{\circ}\text{C}$ and the damp heat severity is 21 days.