



SLOVENSKI STANDARD
SIST EN 60384-1:2002
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**Fixed capacitors for use in electronic equipment - Part 1: Generic specification
(IEC 60384-1:1999)**

Fixed capacitors for use in electronic equipment -- Part 1: Generic specification

Festkondensatoren zur Verwendung in Geräten der Elektronik -- Teil 1:
Fachgrundspezifikation

Condensateurs fixes utilisés dans les équipements électroniques -- Partie 1:
Spécification générique

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31.060.10 Fiksni kondenzatorji Fixed capacitors

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EUROPEAN STANDARD

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English version

Fixed capacitors for use in electronic equipment
Part 1: Generic specification
 (IEC 60384-1:1999, modified)

Condensateurs fixes utilisés dans les
 équipements électroniques
 Partie 1: Spécification générique
 (CEI 60384-1:1999, modifiée)

Festkondensatoren zur Verwendung in
 Geräten der Elektronik
 Teil 1: Fachgrundspezifikation
 (IEC 60384-1:1999, modifiziert)

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This European Standard was approved by CENELEC on 2000-08-01. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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 the International Standard IEC 60384-1:1999, prepared by IEC TC 40, Capacitors and resistors for electronic equipment, together with the common modifications prepared by the Technical Committee CENELEC TC 40XA, was submitted to the formal vote and was approved by CENELEC as EN 60384-1 on 2000-08-01.

This European Standard supersedes EN 130000:1993 and its amendments A8:1995, A9:1995 and A10:1997.

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) 2001-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-08-01

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Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A to D, ZA and ZB are normative and annexes E and F are informative.

Annexes ZA and ZB have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60384-1:1999 was approved by CENELEC as a European Standard with agreed common modifications.

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Cross reference list for comparison of clause numbers between EN 130000 and EN 60384-1

The existing sectional and (blank) detail specifications all refer to EN 130000. Therefore the following cross reference list has been established to indicate the relation between the corresponding clauses in EN 130000 and EN 60384-1 (IEC 60384-1). Technical deviations are indicated by „Y“ in the third column. The clause numbers in the following text refer to EN 60384-1.

Clause number		Modification No/Yes
EN 130000	EN 60384-1	
1	1.1	N
2	1	-
2.1	1.2	Y
2.2	2.1	N
2.2.1	2.1	N
2.2.2	2.2.1	N
2.2.3	2.2.2	N
2.2.4	2.2.3	N
2.2.5	2.2.4	N
2.2.6	2.2.5	N
2.2.7	2.2.6	N
2.2.8	2.2.7	N
2.2.9	2.2.8	N
2.2.10	2.2.9	N
2.2.11	2.2.10	N
2.2.12	2.2.11	N
2.2.13	2.2.12	N
2.2.14	2.2.14	N
2.2.15	2.2.13	N
2.2.16	2.2.15	N
2.2.17	2.2.16	N
2.2.18	2.2.17	N
2.2.19	2.2.18	N
2.2.20	2.2.19	N
2.2.21	2.2.20	N
2.2.22	2.2.21	N
2.2.23	2.2.22	N
2.2.24	2.2.23	N
2.2.25	2.2.24	N
2.2.26	2.2.25	N
2.2.27	2.2.26	N
2.2.28	2.2.27	N
2.2.29	2.2.28 / 29	N

2.2.30.2	2.2.32 / .33	N
2.2.31	2.2.34	N
2.2.32	2.2.35	N
2.2.33	2.2.36	N
2.2.34	2.2.36 Note 2	N
2.2.35	2.2.37	N
2.2.36	2.2.38	N
2.2.37	2.2.39	N
2.2.38	2.2.40	N
2.2.39	2.2.41	N
2.2.40	2.2.42	N
2.2.41	2.2.43	N
2.2.42	2.2.44	N
3	3	Y
4.2.2	4.2.2	Y
4.3.1	4.3.1 / 2	N
4.8	4.8.1	N
4.14.2	4.14.2	Y
4.15.2	4.15.2	Y
4.22.2	4.22.2	Y
4.22.3	4.22.3	Y
4.30	4.30	Y
4.36	4.36	Y
4.37.3	4.37.3	Y
4.39	4.39	Y
4.41	4.8.2	N
Annex A	Annex A	Y
Annex B	Annex F	Y
Annex C	Annex E	N
Annex D	Annex C	N
Annex E	Annex D	N

Clause number		Modification No/Yes
EN 130000	EN 60384-1	
2.2.30	2.2.30	N
2.2.30.1	2.2.31	N

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

1 General

1.1 Scope

This part of IEC 60384 is a generic specification and is applicable to fixed capacitors for use in electronic equipment.

It establishes standard terms, inspection procedures and methods of test for use in sectional and detail specifications of electronic components for quality assessment or any other purpose.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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.

In the case of IEC 60068 publications, the referenced edition shall be used, regardless of any subsequent new edition(s) and amendment(s).

IEC 60027-1:1992, *Letter symbols to be used in electrical technology – Part 1: General*

IEC 60050: *International Electrotechnical Vocabulary (IEV)*
<https://standards.iteh.ai/catalog/standards/sist/85192274-b3fe-4fa1-a5d4-8e386b6d7a1d/iec-60050-1-2002>

IEC 60062:1992, *Marking codes for resistors and capacitors*

IEC 60063:1963, *Preferred number series for resistors and capacitors*
 (incorporating Amendment 1 (1967) and Amendment 2 (1977))

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*
 Amendment 1 (1992)

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*
 Amendment 1 (1993)
 Amendment 2 (1994)

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry Heat*
 Amendment 1 (1993)
 Amendment 2 (1994)

IEC 60068-2-3:1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*
 (incorporating Amendment 1 (1984))


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

IEC 60068-2-13:1983, *Environmental testing – Part 2: Tests – Test M: Low air pressure*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*
 Amendment 1 (1986)

- IEC 60068-2-17:1994, *Environmental testing – Part 2: Tests – Test Q: Sealing*
- IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*
Amendment 2 (1987)
- IEC 60068-2-21:1983, *Environmental testing – Part 2: Tests – Test U: Robustness of terminations and integral mounting devices*
Amendment 2 (1991)
Amendment 3 (1992)
- IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*
- IEC 60068-2-29:1987, *Environmental testing – Part 2: Tests – Test Eb and guidance: Bump*
- IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*
Amendment 1 (1985)
- IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*
Amendment 1 (1993)
- IEC 60068-2-47:1982, *Environmental testing – Part 2: Mounting of components, equipment and other articles for dynamic tests, including shock (Ea), bump (Eb), vibration (Fc and Fd) and steady-state acceleration (Ga) and guidance*
- IEC 60068-2-58:1989, *Environmental testing – Part 2: Tests – Test Td: Solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*
- IEC 60249-2-4:1987, *Base materials for printed circuits – Part 2: Specifications – Specification No. 4: Epoxide woven glass fabric copper-clad laminated sheet, general purpose grade*
- IEC 60294:1969, *Measurement of the dimensions of a cylindrical component having two axial terminations*
[SIST EN 60384-1:2002](https://standards.iteh.ai/catalog/standards/sist/85192274-b3fe-4fa1-a5d4-)
<https://standards.iteh.ai/catalog/standards/sist/85192274-b3fe-4fa1-a5d4->
- IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*
- IEC 60469-1:1987, *Pulse techniques and apparatus – Part 1: Pulse terms and definitions*
- IEC 60469-2:1987, *Pulse techniques and apparatus – Part 2: Pulse measurement and analysis, general considerations*
- IEC 60617: *Graphical symbols for diagrams*
- IEC 60695-2-2:1991, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*
Amendment 1 (1994)
- IEC 60717:1981, *Method of the determination of the space required by capacitors and resistors with unidirectional terminations*
- IEC 61760-1:1998, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDS)*
- IEC QC 001002-3:1998, *Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ) – Part 3: Approval procedures*
- IEC QC 001003: *Guidance Documents*
- IEC QC 001005: *Register of Firms, Products and Services approved under the IECQ system, including ISO 9000*
- ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*
- ISO 9000: *Quality management and quality assurance standards*
- EN 100014:1991, *CECC Assessed Process Average Procedure (APA)*
- EN 100114-1:1996, *Approval of manufacturers and other organizations*

EN 100114-2:1999, *Qualification approval of electronic components*

EN 100114-3:1999, *Capability approval of an electronic component manufacturing activity* 

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2 Technical data

2.1 Units and symbols

Units, graphical symbols and letter symbols should, whenever possible, be taken from the following publications:

- IEC 60027;
- IEC 60050;
- IEC 60617;
- ISO 1000.

When further items are required they should be derived in accordance with the principles of the publications listed above.

2.2 Definitions

For the purpose of this standard, the following definitions apply:

2.2.1

type

a group of components having similar design features and the similarity of whose manufacturing techniques enables them to be grouped together either for qualification approval or for quality conformance inspection

They are generally covered by a single detail specification

NOTE – Components described in several detail specifications, may, in some cases, be considered as belonging to the same type.

2.2.2

style

a subdivision of a type, generally based on dimensional factors. Which may include several variants, generally of a mechanical order

2.2.3

grade

a term to indicate an additional general characteristic concerning the intended application of the component which may only be used in combination with one or more words (e.g. long life grade) and not by a single letter or number

2.2.4

family (of electronic components)

a group of components which predominantly displays a particular physical attribute and/or fulfils a defined function

2.2.5

subfamily (of electronic components)

a group of components within a family manufactured by similar technological methods

2.2.6

d.c. capacitor

a capacitor designed essentially for application with direct voltage

NOTE – A d.c. capacitor may not be suitable for use on a.c. supplies.

2.2.7**polar capacitor** (for electrolytic capacitors)

a capacitor intended for use with a unidirectional voltage connected according to the polarity indication

2.2.8**bipolar capacitor** (for electrolytic capacitors)

an electrolytic capacitor designed to withstand an alternating voltage and/or reversal of the applied direct voltage

2.2.9**a.c. capacitor**

a capacitor designed essentially for application with alternating voltages

2.2.10**pulse capacitor**

a capacitor for use with pulses of current or voltage

NOTE – The definitions of IEC 60469-1 and IEC 60469-2 apply.

2.2.11**rated capacitance (C_R)**

the designated capacitance value usually indicated on the capacitor

2.2.12**category temperature range**

the range of ambient temperatures for which the capacitor has been designed to operate continuously; this is given by the lower and upper category temperature

2.2.13**lower category temperature**

the minimum ambient temperature for which a capacitor has been designed to operate continuously

2.2.14**upper category temperature**

the maximum ambient temperature for which a capacitor has been designed to operate continuously

2.2.15**rated temperature**

the maximum ambient temperature at which the rated voltage may be continuously applied

2.2.16**rated voltage (d.c.) (U_R)**

the maximum direct voltage or peak value of pulse voltage which may be applied continuously to a capacitor at any temperature between the lower category temperature and the rated temperature

2.2.17**category voltage (U_C)**

the maximum voltage which may be applied continuously to a capacitor at its upper category temperature

2.2.18**temperature derated voltage**

the maximum voltage that may be applied continuously to a capacitor, when it is at any temperature between the rated temperature and the upper category

NOTE – Information on the voltage/temperature dependence at temperatures between the rated temperature and the upper category temperature should, if applicable, be given in the relevant specification.

2.2.19**surge voltage ratio**

the quotient of the maximum instantaneous voltage which may be applied to the terminations of the capacitor for a specified time at any temperature within the category temperature range and the rated voltage or the temperature derated voltage, as appropriate

NOTE – The number of times per hour that this voltage may be applied should be specified.

2.2.20**rated ripple voltage**

the r.m.s. value of the maximum allowable alternating voltage at a specified frequency superimposed on the d.c. voltage at which the capacitor may be operated continuously at a specified temperature

NOTE – The sum of the direct voltage and the peak value of the alternating voltage applied to the capacitor should not exceed the rated voltage or temperature derated voltage as applicable.

2.2.21**reverse voltage** (for polar capacitors only)

a voltage applied to the capacitor terminations in the reverse polarity direction

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2.2.22**rated ripple current**

the r.m.s. value of the maximum allowable alternating current of a specified frequency, at which the capacitor may be operated continuously at a specified temperature

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2.2.23**time constant**

the product of the insulation resistance and the capacitance, normally expressed in seconds

2.2.24**tangent of loss angle ($\tan \delta$)**

the power loss of the capacitor divided by the reactive power of the capacitor at a sinusoidal voltage at a specified frequency

2.2.25**self-healing**

the process by which the electrical properties of the capacitor, after a local breakdown of the dielectric, are rapidly and essentially restored to the values before the breakdown

2.2.26**maximum temperature of a capacitor**

the temperature at the hottest point of its external surface

NOTE – The terminations are considered to be part of the external surface.

2.2.27**minimum temperature of a capacitor**

the temperature at the coldest point of the external surface

NOTE – The terminations are considered to be part of the external surface.

2.2.28**minimum storage temperature**

the minimum ambient temperature which the capacitor shall withstand in the non-operating condition without damage

2.2.29**maximum storage temperature**

the maximum ambient temperature which is equal to the upper category temperature of the capacitor

2.2.30**variation of capacitance with temperature**

the variation of capacitance with temperature expressed either as the temperature characteristic of capacitance or as the temperature coefficient of capacitance

2.2.31**temperature characteristic of capacitance**

the maximum reversible variation of capacitance produced over a given temperature range within the category temperature range, normally expressed as a percentage of the capacitance related to a reference temperature of 20 °C

NOTE – The term characterizing this property applies mainly to capacitors of which the variations of capacitance as a function of temperature, linear or non-linear, cannot be expressed with precision and certainty.

2.2.32**temperature coefficient of capacitance (α)**

the rate of change of capacitance with temperature measured over a specified range of temperature, normally expressed in parts per million per kelvin ($10^{-6}/K$)

NOTE – The term characterizing this property applies to capacitors of which the variations of capacitance as a function of temperature are linear or approximately linear and can be expressed with a certain precision.

2.2.33**temperature cyclic drift of capacitance**

the maximum irreversible variation of capacitance observed at room temperature during or after the completion of a number of specified temperature cycles; it is expressed normally as a percentage of the capacitance related to a reference temperature, usually 20 °C

NOTE 1 – The term characterizing this property applies to capacitors of which the variations of capacitance as a function of temperature are linear or approximately linear and can be expressed with a certain precision.

NOTE 2 – The conditions of measurement, during or after temperature cycling, a description of the temperature cycle and the number of cycles, should be stated.

2.2.34**visible damage**

visible damage which reduces the usability of the capacitor for its intended purpose

2.2.35**rated a.c. load**

the maximum sinusoidal a.c. load which may be applied continuously to the terminations of a capacitor at any temperature between the lower category temperature and the rated temperature (see 2.2.15); it may be expressed:

- at low frequencies as a rated a.c. voltage;
- at high frequencies as a rated a.c. current;
- at intermediate frequencies as a rated reactive power.

This is shown in the figure 1:

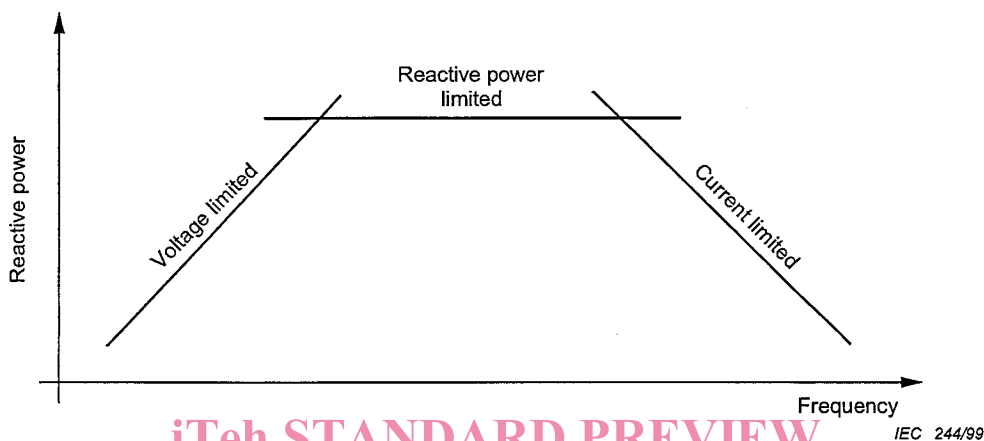


Figure 1 – Reactive power against frequency

NOTE 1 – For a particular type of capacitor it may be necessary to specify one or more of the above characteristics.

NOTE 2 – Capacitors within the scope of this specification are normally less than 500 var at 50 Hz to 60 Hz. Low frequencies may be 50 Hz to 60 Hz, 100 Hz to 120 Hz, or 400 Hz. Voltages may be up to 600 V r.m.s. at 50 Hz to 60 Hz. However, capacitors for filters, transmitter or converter circuits may be required to operate under power over a wide range of frequencies and up to 10 kvar at the higher frequencies with voltages up to 1 000 V r.m.s.

2.2.36**rated pulse load**

the maximum pulse load which may be applied at a certain pulse repetition frequency to the terminations of a capacitor at any temperature between the lower category temperature and the rated temperature (see 2.2.15); it may be expressed as a) and b) and any of the remaining items:

- peak current per μF or du/dt ($\text{V}/\mu\text{s}$);
- relative duration of charge and discharge periods;
- current;
- peak voltage;
- peak reverse voltage;
- pulse repetition frequency (see note 1);
- maximum active power.

These parameters are fixed for periodic pulses.

NOTE 1 – In the case of intermittent pulses the duty cycle shall be specified. In the case of random pulses, the total number expected over a given time period should be stated.

NOTE 2 – The r.m.s. pulse current this should be calculated in accordance with 2.5.2.4 of IEC 60469-1. In the case of intermittent or random pulses, the time interval should be chosen to correspond with the maximum temperature rise.