IEC 60384-1

Edition 6.0 2021-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

IEC 60384-1:2021-07(en-fr)

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FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

FOREWORD

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IEC 60384-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This sixth edition cancels and replaces the fifth 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) The document has been completely restructured to comply with the ISO/IEC Directives, Part 2; a new technical categorization of test methods has been introduced and the test methods have been reorganized according to these new categories; tables, figures and references have been revised accordingly.
b) Annex X has been added for comparison with the previous edition.

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

FDIS	Report on voting
40/2848/FDIS	40/2859/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.

A list of all parts in the IEC 60384 series, published under the general title *Fixed capacitors for use in electronic equipment*, can be found on the IEC website.

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- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The specification system for fixed capacitors for use in electronic equipment is structured in a hierarchical system consisting of the following specification types. See Figure 1.

Generic specification

The generic specification covers all subjects mainly common to the family of fixed capacitors for use in electronic equipment, such as terminology, methods of measurement and tests. Where the individual subjects require the conditions or parameters for provisions specific to the particular subfamily or type of fixed capacitor, such are required to be given by one of the subordinate specifications.

For the scope of fixed capacitors, the numeric reference to the generic specification is IEC 60384-1.

Sectional specification

Sectional specifications cover all subjects additional to those given in the generic specification, which are specific to a defined subgroup of fixed capacitors. These subjects normally are preferred values for dimensions and characteristics, additional test methods and relevant provisions for test methods given in the generic specification, requirements for sampling and for the preparation of specimen, recommended test severities and preferred acceptance criteria. The sectional specification also outlines the structure and scope of the test schedules which are to be applied in all subordinate detail specifications.

For the scope of fixed capacitors, the numeric references to the sectional specifications reach from IEC 60384-2 for polyester film capacitors to currently IEC 60384-26 for aluminum electrolytic capacitors with conductive polymer solid electrolyte. The variety of sectional specifications may be adapted to the portfolio of different technologies of fixed capacitors.

Detail specification

Detail specifications give directly, or by referring to other specifications, all information necessary to completely describe a given type and range of fixed capacitors, including requirements of all values for dimensions and characteristics. They also give all information required for the quality assessment of the covered type and range of fixed capacitors within a suitable quality assessment system, including requirements for all applied test severities and acceptance criteria, and the completed test schedules.

Detail specifications can be either specifications within the IEC system, another specification system linked to IEC, or specified by the manufacturer or user.

For the scope of fixed capacitors, the numeric references to detail specifications are for example IEC 60384-3-101, if related to the sectional specification IEC 60384-3 and to the ancillary blank detail specification IEC 60384-3-1.

Blank detail specification

The hierarchical system of specifications is supplemented by one or more blank detail specifications to a sectional specification, which are used to ensure a uniform presentation of detail specifications.

The blank detail specifications provide the specification writer with a template on the layout to be adopted and on the information to be given and with guidance for the preparation of detail specifications in line with the requirements of the superior generic or sectional specifications.

Blank detail specifications are not considered as relevant specifications since they do not themselves describe any particular component.

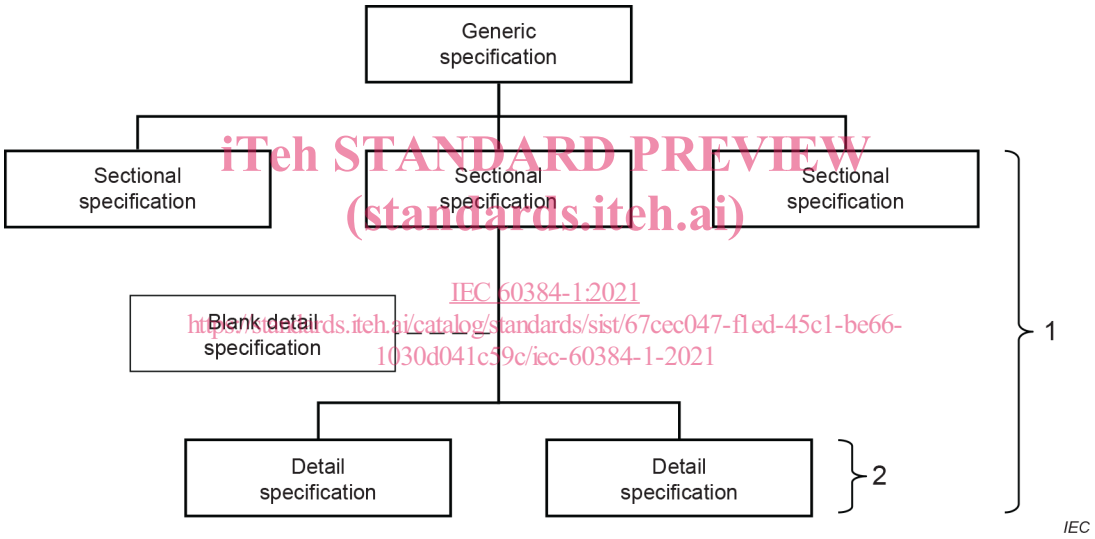
The presence of an established hierarchical specification system with blank detail specifications permits the preparation of detail specifications even outside of the relevant IEC technical committee.

For the scope of fixed capacitors, the numeric references to blank detail specifications are, for example, IEC 60384-3-1, if related to the sectional specification IEC 60384-3.

Relevant specification

In this system the term "relevant specification" addresses subordinate specifications containing specific requirements, where applicable.

Any generic or sectional specification may use abstract and universal references to subordinate specifications of either hierarchical level by use of the expression "relevant specification".



Key

1 Indicates the range of "*Relevant specifications*" to the superior generic specification, where applicable.

2 Indicates the range of "*Relevant specifications*" to the superior sectional specification, where applicable.

Figure 1 – Specification system for fixed capacitors

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 1: Generic specification

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.

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 60062, *Marking codes for resistors and capacitors*

IEC 60063, *Preferred number series for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Tests A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Tests B: Dry heat*

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

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

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-17, Basic *environmental testing procedures – Part 2-17: Tests – Test Q: Sealing*

IEC 60068-2-20, *Environmental testing – Part 2-20: Tests – Test Ta and Tb: Test methods for solderability and resistance to soldering heat of devices with leads*

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

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-45:1980, *Basic environmental testing procedures – Part 2-45: Tests – Test XA and guidance: Immersion in cleaning solvents*
IEC 60068-2-45:1980/AMD1:1993

IEC 60068-2-58, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-67, *Environmental testing – Part 2-67: Tests – Test Cy: Damp heat, steady state, accelerated test primarily intended for components*

IEC 60068-2-69, *Environmental testing – Part 2-69: Tests – Test Te/Tc: Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60068-2-82:2019, *Environmental testing – Part 2-82: Tests – Test Xw1: Whisker test methods for components and parts used in electronic assemblies*

IEC 60294, *Measurement of the dimensions of a cylindrical component with axial terminations*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60717, *Method for the determination of the space required by capacitors and resistors with unidirectional terminations*

IEC 61193-2, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

IEC 61249-2-7, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

ISO 3, *Preferred numbers – Series of preferred numbers*

3 Terms and definitions

For the purposes of this document and the subordinate specifications, 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

NOTE They have been listed in alphabetical order.

3.1
AC capacitor
capacitor designed essentially for application with alternating voltages

3.2
bipolar capacitor
<electrolytic capacitor> capacitor designed to withstand an alternating voltage and/or reversal of the applied direct voltage

3.3
category of passive flammability
category indicating the maximum burning time after a specified time of flame application

3.4
category temperature range
ambient temperature range for which the capacitor has been designed to operate continuously

Note 1 to entry: The temperature range is limited by the lower and upper category temperature (see 3.10 and 3.41).

3.5
category voltage
U_C
maximum voltage that can be applied continuously to a capacitor at its upper category temperature (3.41)

3.6
DC capacitor
capacitor designed essentially for application with direct voltage

Note 1 to entry: It may not be suitable for use on AC supplies.

3.7
family
<electronic components> group of components which predominantly displays a particular physical attribute and/or fulfils a defined function

3.8
grade
additional general characteristic concerning the intended application of the component

3.9
insulated capacitor
capacitor in which all terminations of a section may be raised to a potential different (but not less than the rated voltage) from that of any conducting surface with which the case is liable to come into contact in normal use

3.10
lower category temperature
LCT
minimum ambient temperature for which a capacitor has been designed to operate continuously

Note 1 to entry: The lower category temperature in some tests is abbreviated as T_A.

3.11
maximum storage temperature
maximum ambient temperature which the capacitor withstands in the non-operating condition without damage

3.12
maximum temperature
<of a capacitor> temperature at the hottest point of its external surface

Note 1 to entry: The terminations are considered to be part of the external surface.

3.13
minimum storage temperature
minimum ambient temperature which the capacitor withstands in the non-operating condition without damage

3.14
minimum temperature
<of a capacitor> temperature at the coldest point of the external surface

Note 1 to entry: The terminations are considered to be part of the external surface.

3.15
nominal capacitance
C_N
designated capacitance value, usually indicated on the capacitor

3.16
passive flammability
ability of a capacitor to burn with a flame as a consequence of the application of an external source of heat

3.17
polar capacitor
<electrolytic capacitor> capacitor intended for use with a unidirectional voltage connected according to the polarity indication

3.18
pulse capacitor
capacitor for use with pulses of current or voltage

Note 1 to entry: The definitions of IEC 60469 apply.

3.19
pulse equivalent circuit
<of a capacitor> equivalent circuit consisting of an ideal capacitor in series with its residual inductance and the equivalent series resistance (ESR)

Note 1 to entry: For pulse operation the equivalent series resistance will be similar to, but not identical with, the ESR measured with a sinusoidal voltage. The pulse ESR depends on the series of harmonics in the pulse and the variation of the losses with frequency.

3.20
rated AC load
maximum sinusoidal AC load which may be applied continuously to the terminations of a capacitor at any temperature between the lower category temperature (3.10) and the rated temperature (3.24)

3.21
rated pulse load
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 (3.10) and the rated temperature (3.24)

3.22
rated ripple current
RMS value of the maximum allowable alternating current of a specified frequency, at which the capacitor can be operated continuously at a specified temperature

Note 1 to entry: As the ripple current will generate a ripple voltage across the capacitor, 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.

3.23
rated ripple voltage
RMS value of the maximum allowable alternating voltage at a specified frequency superimposed on the DC voltage at which the capacitor may be operated continuously at a specified temperature

Note 1 to entry: 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.

3.24
rated temperature
maximum ambient temperature at which the rated voltage may be continuously applied

3.25
rated voltage
U_R

3.25.1
rated DC voltage
maximum DC voltage which may be applied continuously to a capacitor at the rated temperature (3.24)

Note 1 to entry: The maximum DC voltage is the sum of the DC voltage and peak AC voltage or peak pulse voltage applied to the capacitor.

3.25.2
rated AC voltage
maximum RMS alternating voltage which may be applied continuously to a capacitor at the rated temperature (3.24) and at a given frequency

3.25.3
rated pulse voltage
peak value of the pulse voltage within a given pulse wave form which may be applied continuously to a capacitor at the rated temperature (3.24)

3.26
reverse voltage
<polar capacitor> voltage applied to the capacitor terminations in the reverse polarity direction

Note 1 to entry: Reverse voltage applies to polar capacitors only.

3.27
self-healing
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

3.28
style
subdivision of a type (3.39), generally based on dimensional factors, which may include several variants, generally of a mechanical order

3.29
subfamily
<electronic components> group of components within a family (3.7) manufactured by similar technological methods