

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Fixed electric double-layer capacitors for use in electric and electronic equipment –
Part 1: Generic specification**

**Condensateurs électriques fixes à double couche utilisés dans les équipements
électriques et électroniques –
Partie 1: Spécification générique**



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Partie 1: Spécification générique**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIXED ELECTRIC DOUBLE-LAYER CAPACITORS
FOR USE IN ELECTRIC AND ELECTRONIC EQUIPMENT –****Part 1: Generic specification**

FOREWORD

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IEC 62391-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This third edition cancels and replaces the second edition published in 2015. 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) Calculation formula of charging/discharging efficiency in Annex D were divided into two cases: "Calculation assuming full charge and discharge" and "Calculation assuming incomplete charging and discharging due to internal resistance".

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

Draft	Report on voting
40/2966/FDIS	40/2976/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.

A list of all parts in the IEC 62391 series, published under the general title *Fixed electric double-layer capacitors for use in electric and electronic equipment*, can be found on the IEC website.

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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FIXED ELECTRIC DOUBLE-LAYER CAPACITORS FOR USE IN ELECTRIC AND ELECTRONIC EQUIPMENT –

Part 1: Generic specification

1 Scope

This part of IEC 62391 applies to fixed electric double-layer capacitors (hereafter referred to as capacitors) mainly used in DC circuits of electric and electronic equipment.

This part of IEC 62391 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 60068-2-1:2007, *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 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

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 of with leads*

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

IEC 60068-2-45:1980, *Environmental testing – 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 60068-2-69, *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 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*

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>

3.1

active flammability

flammability (self-ignition) caused by internal heating of the component

Note 1 to entry: Active flammability can be caused by sparking due to insufficient internal contact for example.

3.2

category of passive flammability

category given by the maximum burning time after a specified time of flame application

3.3

category temperature range

range of ambient temperatures for which the capacitor has been designed to operate continuously

Note 1 to entry: This is given by the lower category temperature and the upper category temperature.

3.4

category voltage

U_C

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

Note 1 to entry: This term is not used in the document and is given for information only.

3.5

class

classification of the capacitor by the capacitance value and the internal resistance value depending upon the application

3.6

DC capacitor

capacitor designed essentially for application with direct voltage

Note 1 to entry: A DC capacitor can be unsuitable for use on AC supplies.

Note 2 to entry: This term is not used in the document and is given for information only.

3.7 family

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

3.8 inset limits

tightened limits resulting from an allowance applied to the specified limits of a parameter to take into account all influence quantities on the indication of a measuring instrument so as to ensure that out of limit devices are not accepted due to measurement errors

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

Note 1 to entry: This term is not used in the document and is given for information only.

3.10 internal resistance

resistance component in an equivalent series circuit of capacitance and resistance of a capacitor

Note 1 to entry: The internal resistance is given in ohms (Ω).

3.11 IR drop

voltage drop between the capacitor terminals that is generated at the start of discharge and quantified by the product of the discharge current and the internal resistance of the capacitor

Note 1 to entry: This term is not used in the document and is given for information only.

3.12 leakage current

value of the current that flows through a capacitor after a charge for a fixed period of time

Note 1 to entry: Leakage current is given in amperes (A).

Note 2 to entry: Usually, it is the sum of the current for charging the capacitor, which decreases exponentially with time, and the dark current (leakage current in the original sense) of the capacitor itself.

3.13 lower category temperature

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

3.14 maintain voltage

self-discharge

voltage held while being left for a fixed period of time under no load after a charge for a fixed period of time

3.15 mass

all fixed parts of the capacitor

Note 1 to entry: This term is not used in the document and is given for information only.

3.16

maximum storage temperature

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

Note 1 to entry: This term is not used in the document and is given for information only.

[SOURCE: IEC 60384-1:2021, 3.11, modified – Note 1 to entry has been added.]

3.17

maximum temperature of a capacitor

temperature at the hottest point of its external surface

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

Note 2 to entry: This term is not used in the document and is given for information only.

3.18

measuring equipment

instruments that are necessary in order to carry out a measurement

Note 1 to entry: The definition makes it clear that items such as cables, connectors, handlers, handler cards or other fixtures used in conjunction with a measurement indicating instrument are subject to the requirements of this policy.

3.19

minimum storage temperature

minimum ambient temperature that the capacitor should withstand in the non-operating condition without damage

Note 1 to entry: This term is not used in the document and is given for information only.

3.20

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.

Note 2 to entry: This term is not used in the document and is given for information only.

3.21

nominal capacitance

C_N

designated capacitance value usually indicated on the capacitor

3.22

outset limits

relaxed limits resulting from an allowance applied to the specified limits of a parameter to take into account all influence quantities on the indication of a measuring instrument so as to ensure that in-limit devices are not rejected due to measurement errors

3.23

passive flammability

flammability caused by external heating of the component

Note 1 to entry: Passive flammability can be caused by flames, for example.

3.24

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: This term is not used in the document and is given for information only.

3.25 rated ripple voltage

RMS value of the maximum allowable alternating voltage at a specified frequency superimposed on the DC voltage at which the capacitor can 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 does not exceed the rated voltage or temperature derated voltage, as applicable.

Note 2 to entry: This term is not used in the document and is given for information only.

3.26 rated temperature

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

3.27 rated voltage

U_R

maximum DC voltage or peak value of pulse voltage that can be applied continuously or repetitively to a capacitor at any temperature between the lower category temperature and the rated temperature

3.28 reverse voltage

voltage applied to the capacitor terminations in the reverse polarity direction

Note 1 to entry: This term is not used in the document and is given for information only.

3.29 style

subdivision of a type, generally based on dimensional factors

Note 1 to entry: A style can include several variants, generally of a mechanical order.

Note 2 to entry: This term is not used in the document and is given for information only.

3.30 subfamily

<electronic components> group of components within a family manufactured by similar technological methods

3.31 surface mount capacitor

fixed capacitor whose small dimensions and nature or shape of terminations make it suitable for use in hybrid circuits and on printed boards

3.32 surge voltage ratio

quotient of the maximum instantaneous voltage that can 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 1 to entry: The number of times per hour that this voltage can be applied is specified in the detail specification.

Note 2 to entry: This term is not used in the document and is given for information only.

3.33 temperature characteristic of capacitance

maximum reversible variation of capacitance produced over a given temperature range within the category temperature range