

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

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

IEC 62391-1:2006

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX



ICS 31.060.10

ISBN 978-2-83220-140-4

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

Part 1: Generic specification

FOREWORD

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

This bilingual version (2012-06) corresponds to the monolingual English version, published in 2006-04.

The text of this standard is based on the following documents:

FDIS	Report on voting
40/1640/FDIS	40/1712/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 62391 consists of the following parts, under the general title *Fixed electric double layer capacitors for use in electronic equipment*

Part 1: Generic specification

Part 2: Sectional specification – Electric double-layer capacitors for power application

The sectional specification mentioned above does have a blank detail specification being a supplementary document, containing requirements for style, layout and minimum content of detail specifications.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

Part 1: Generic specification

1 General

1.1 Scope

This part of IEC 62391 applies to fixed electric double layer capacitors (hereafter called “capacitor(s)”) mainly used in DC circuits of 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 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 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)*

IEC 60062, *Marking codes for resistors and capacitors*

<https://www.intel.com/content/www/us/en/programmable/development-core.htm> IEC 60063, *Preferred number series for resistors and capacitors*

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

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

IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*
Amendment 2 (1987)

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

IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*
Amendment 1 (1993)

IEC 60068-2-47:1999, *Environmental testing – Part 2-47: Test methods – Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests*

IEC 60068-2-58:2004, *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 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state.*

IEC 60294:1969, *Measurement of the dimensions of a cylindrical component having two axial terminations*

IEC 60617 (all parts) [DB]¹, *Graphical symbols for diagrams*

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

IEC 60717:1981, *Method for 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)*

QC001002-3, *Rules of procedure – Part 3: Approval procedures*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*

2 Technical data

2.1 Unit and symbols

Units, graphical symbols, letter symbols and terminology shall, 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.

¹ DB" refers to the IEC on-line database.

2.2 Terms and definitions

For the purpose of this document, the following terms and definitions apply:

2.2.1

type

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

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

2.2.3

grade

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)

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

2.2.5

subfamily (of electronic components)

group of components within a family manufactured by similar technological methods

2.2.6

d.c. capacitor

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

rated capacitance

C_R

designated capacitance value usually indicated on the capacitor

2.2.8

category temperature range

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

2.2.9

lower category temperature

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

2.2.10

upper category temperature

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

2.2.11**rated temperature**

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

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

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

2.2.13**category voltage** U_C

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

2.2.14**temperature derated voltage**

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

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.

2.2.15**surge voltage ratio**

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.

2.2.16**rated ripple voltage**

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.

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

voltage applied to the capacitor terminations in the reverse polarity direction

2.2.18**rated ripple current**

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

2.2.19**time constant**

product of the internal resistance (including circuit resistance) and the capacitance, normally expressed in seconds

2.2.20**internal resistance**

expresses the resistance component in an equivalent series circuit of capacitance and resistance of a capacitor, given in ohms (Ω)

2.2.21

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

2.2.22

maximum temperature of a capacitor

temperature at the hottest point of its external surface

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

2.2.23

minimum temperature of a capacitor

temperature at the coldest point of the external surface

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

2.2.24

minimum storage temperature

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

2.2.25

maximum storage temperature

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

2.2.26

temperature characteristic of capacitance

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.

2.2.27

visible damage

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

2.2.28

leakage current

value of the current that flows through a capacitor after a charge for a fixed period of time, given in amperes (A)

2.2.29

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

2.2.30

temperature rise

temperature rise of the capacitor relative to the ambient temperature resulting from the losses in the capacitor due to operation under a.c. or pulse conditions

2.2.31

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

2.2.32**uninsulated capacitor**

capacitor in which one or more of the terminations of a section cannot 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

2.2.33**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

2.2.34**passive flammability**

flammability caused by external heating of the component (e.g. by flames)

2.2.35**active flammability**

flammability (self-ignition) caused by internal heating of the component (e.g. sparking due to insufficient internal contact)

2.2.36**category of passive flammability**

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

2.2.37**mass**

mass of the component with all fixed parts

2.2.38**volume**

component body without terminations

2.3 Preferred values**2.3.1 General**

Each sectional specification shall prescribe the preferred values appropriate to the subfamily; for rated capacitance, see also 2.3.2.

2.3.2 Preferred values of rated capacitance

The preferred values of rated capacitance shall be taken from the series specified in IEC 60063.

2.4 Marking**2.4.1 General**

The sectional specification shall indicate the identification criteria and other information to be shown on the capacitor and/or packing.

The order of priority for marking small capacitors shall be specified.

2.4.2 Coding

When coding is used for capacitance value, tolerance or date of manufacture, the method shall be selected from those given in IEC 60062.

3 Quality assessment procedures

3.1 General

When this standard, and any related standards are used for the purpose of a full quality assessment system such as IEC Quality Assessment System for Electronic Components (IECQ), compliance with IEC QC 001002-3 is required.

3.2 Primary stage of manufacture

The primary stage of manufacture shall be specified in the sectional specification.

3.3 Structurally similar components

The structurally similar components shall be specified in the sectional specification.

3.4 Declaration of conformity

The declaration of conformity shall be specified in the sectional specification.

3.5 Test schedule and requirement for initial assessment

The test schedule and requirement for initial assessment shall be specified in the sectional specification.

4 Tests and measurement procedures

4.1 General

The sectional and/or blank detail specification shall indicate the tests to be made, which measurements are to be made before and after each test or subgroup of tests, and the sequence in which they shall be made. The stages of each test shall be carried out in the order written. The measuring conditions shall be the same for initial and final measurements.

If national specifications within any quality assessment system include methods other than those specified in the above specifications, they shall be fully described.

Limits given in all specifications are absolute limits. The principle to take measurement uncertainty into account shall be applied (see Annex C to Clause 2 of IEC QC 001002-3).

4.2 Standard atmospheric conditions

4.2.1 Standard atmospheric conditions for testing

Unless otherwise specified, all tests and measurements shall be made under standard atmospheric conditions for testing as given in 5.3 of IEC 60068-1:

- temperature: 15 °C to 35 °C;
- relative humidity: 25 % to 75 %;
- air pressure: 86 kPa to 106 kPa.

Before the measurements are made, the capacitor shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature. The period as prescribed for recovery at the end of a test is normally sufficient for this purpose.