IEC 62391-2

Edition 2.0 2025-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fixed electric double-layer capacitors for use in electric and electronic equipment –
Part 2: Sectional specification – Electric double-layer capacitors for power application

Condensateurs électriques fixes à double couche utilisés dans les équipements électriques et électroniques –
Partie 2: Spécification intermédiaire – Condensateurs électriques à double couche pour application de puissance

IEC 62391-2:2025-02(en-fr)

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

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IEC 62391-2 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This International Standard is to be used in conjunction with IEC 62391-1:2022.

This second edition cancels and replaces the first edition published in 2006. 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;

b) introduction of a new technical categorization for the test methods;

c) reorganization of the test methods according to these new categories;

d) revision of the tables, figures and references according to changes.

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

Draft	Report on voting
40/3193/FDIS	40/3199/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/publications.

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.

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, or
- revised.

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

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

1 Scope

This part of IEC 62391 applies to electric double-layer capacitors for power application.

Electric double-layer capacitors for power are intended for applications that require discharge currents in the range from mA to A. The characteristics of the capacitors include such performance as relatively high capacitance and low internal resistance, which is applicable to Class 3 and Class 5 of the measurement classification specified in IEC 62391-1:2022.

The object of this document is to specify preferred ratings and characteristics and to select from IEC 62391-1:2022 the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements specified in detail specifications referring to this document provide specific test severities and requirements of an equal or higher performance level.

The definition of power density and its calculating procedure can be found in Annex A.

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 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14:2023, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-20:2021, *Environmental testing – Part 2-20: Tests – Test Ta and Tb: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60417, *Graphical symbols for use on equipment,* available at http://www.graphical-symbols.info/equipment

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

IEC 62391-1:2022, *Fixed electric double-layer capacitors for use in electric and electronic equipment – Part 1: Generic specification*

IEC 62391-2-1:2006, *Fixed electric double-layer capacitors for use in electronic equipment – Part 2-1: Blank detail specification – Electric double-layer capacitors for power application – Assessment level EZ*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62391-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
surface mount capacitor
capacitor whose small dimensions and nature or shape of terminations make it suitable for surface mounting

3.2
electric double-layer capacitor for power application
capacitor with relatively high capacitance and low internal resistance characteristics

Note 1 to entry: Capacitors are intended for applications that require discharge currents in the range from milliamps to amps and are applicable to Class 3 and Class 5 of the measurement classification specified in IEC 62391-1:2022.

3.3
power density
P_d
electric power that can be taken out per mass (W/kg) or volume (W/l) of a capacitor

Note 1 to entry: Refer to Annex A.

Note 2 to entry: The higher the power density is, the higher the current can be taken efficiently.

4 Preferred ratings and characteristics

4.1 Preferred characteristics

The values given in the detail specification should be selected from the following:

The surface mount capacitors covered by this document are classified into climatic categories in accordance with the general rules given in IEC 60068-1:2013, Annex A.

The lower and upper category temperatures and the duration of the damp-heat, steady-state test shall be chosen from the following unless otherwise agreed between the manufacturer and the customer.

Lower category temperature:	−25 °C or −40 °C
Upper category temperature:	+60 °C or +70 °C
Duration of the damp-heat, steady-state test:	10 days

The severities of the cold and dry heat tests are the lower and upper category temperatures respectively.

For the damp-heat steady-state test, the atmospheric conditions shall be as follows:

- temperature: 40 °C ± 2 °C;
- relative humidity: 93 % ± 3 %.

4.2 Preferred values of ratings

4.2.1 Nominal capacitance (C_N)

The nominal capacitance shall be expressed in farads (F) and agreed between the manufacturer and the customer. Preferred values of rated capacitance are the values from the E24 series of IEC 60063 and their decimal multiples.

4.2.2 Tolerance on nominal capacitance

The preferred values of tolerance on nominal capacitance are:

±20 % or −20 % / +80 %.

4.2.3 Rated voltage (U_R)

The rated voltage shall be as agreed between the manufacturer and the customer. The preferred values of the rated direct voltages are the values of the R20 series of ISO 3 and their decimal multiples.

4.2.4 Rated temperature

The rated temperature value is 60 °C or 70 °C, unless otherwise agreed between the manufacturer and the customer.

4.2.5 Internal resistance

The internal resistance shall be as agreed between the manufacturer and the customer. The internal resistance shall be measured with the DC resistance method. However, if a coefficient can be obtained from both DC and AC resistance methods, the AC resistance method may be used for measurement.

5 Test and measurement procedures, and performance requirements

5.1 General

Test severities and requirements specified in detail specifications and referring to this document are of equal or higher performance level, because lower performance levels are not permitted.

This clause supplements information given in IEC 62391-1:2022, Clause 5 to Clause 10.

5.2 Preliminary drying

If specified in the detail specification, the conditions shall be as given in IEC 62391-1:2022, 5.3.

5.3 Test conditions and measurement conditions

Test conditions: IEC 62391-1:2022, 5.2.1 applies.

Measurement conditions: IEC 62391-1:2022, 5.2.2 applies.

5.4 Visual examination and check of dimensions

5.4.1 General

IEC 62391-1:2022, 7.1, applies with the following details.

5.4.2 Visual examination

A visual examination shall be carried out with suitable equipment with approximately 10× magnification and lighting appropriate to the specimen under test and the quality level required.

The operator should have available facilities for incident or transmitted illumination as well as an appropriate measuring facility.

5.4.3 Requirements

The capacitors shall be examined to verify that the materials, design, construction, physical dimensions and workmanship are in accordance with the applicable requirements given in the detail specification.

5.5 Electrical tests

5.5.1 Capacitance

5.5.1.1 General

IEC 62391-1:2022, 6.1, applies with the following details:

5.5.1.2 Measurement conditions

The ambient temperature shall be 20 °C ± 2 °C.

The measurement shall be made under the conditions specified in IEC 62391-1:2022, 6.1.3.3.

5.5.1.3 Requirements

The capacitance shall correspond with the rated value taking into account the specified tolerance.

5.5.2 Internal resistance

5.5.2.1 General

IEC 62391-1:2022, 6.1, applies with the following details.

The AC resistance method may be used when a correlation is found with the results of the DC measurement method. The measurement method should be in accordance with IEC 62391-1:2022, 6.2.2.

5.5.2.2 Measurement conditions

The ambient temperature shall be 20 °C ± 2 °C.

The measurement shall be made under the conditions specified in IEC 62391-1:2022, 6.1.3.3.

5.5.2.3 Requirements

The internal resistance shall meet the requirements of the detail specification.

5.5.3 Leakage current

5.5.3.1 General

IEC 62391-1:2022, 6.3, applies with the following details.

5.5.3.2 Measurement conditions

The ambient temperature shall be 20 °C ± 2 °C.

The rated voltage shall be applied across the capacitor and its protective resistor.

The protective resistor shall have a value of 1 000 Ω or less.

The discharge time before the test shall be at least 12 h, unless otherwise agreed between the manufacturer and the customer.

The electrification time shall be 24 h unless otherwise agreed between the manufacturer and the customer.

5.5.3.3 Requirements

The leakage current (at 20 °C ± 2 °C) shall meet the requirements of the detail specification.

5.6 Robustness of terminations

5.6.1 General

IEC 62391-1:2022, 7.2, applies with the following details.

The detail specification shall specify the test method and degree of severity to be used.

5.6.2 Initial measurement

The capacitance shall be measured in accordance with 5.5.1.

5.6.3 Final inspection, measurements and requirements

The capacitors shall be visually examined and shall meet the requirements shown in Table 2.

5.7 Resistance to soldering heat

5.7.1 General

IEC 62391-1:2022, 9.1, applies with the following details.

NOTE Not applicable to capacitors with screw terminations or other terminations not designed to be soldered, as stated in the detail specification.

5.7.2 Initial measurement

The capacitance shall be measured in accordance with 5.5.1.

5.7.3 Conditions

No pre-drying.

The capacitors shall be tested in accordance with IEC 60068-2-20:2021, 5.2, method 1 of Test Tb.

Immersion time shall be 5 s ± 0,5 s.

5.7.4 Final inspection, measurements and requirements

The capacitors shall be visually examined, electrically measured and shall meet the requirements shown in Table 2.

5.8 Solderability

5.8.1 General

IEC 62391-1:2022, 9.2, applies with the following details.

NOTE Not applicable to capacitors with screw terminations or other terminations not designed to be soldered, as stated in the detail specification.

5.8.2 Final inspection, measurements and requirements

The capacitors shall be visually examined and shall meet the requirements shown in Table 2.

5.9 Rapid change of temperature

5.9.1 General

IEC 62391-1:2022, 8.1, applies with the following details.

5.9.2 Initial measurement

The capacitance shall be measured in accordance with 5.5.1.

5.9.3 Conditioning

The capacitance shall be tested in accordance with IEC 60068-2-14:2023, Clause 7, test Na for 5 cycles.

The exposure time at each temperature limit shall be 30 min to 3 h as specified in the detail specification.

The recovery period shall be 16 h.

5.9.4 Final inspection, measurements and requirements

After recovery, the capacitors shall be visually examined, electrically measured and shall meet the requirements shown in Table 2.