INTERNATIONAL STANDARD

IEC 60384-4

QC 300300

Fourth edition
2007-03

Fixed capacitors for use in electronic equipment –

Part 4:
Sectional specification –
Aluminium electrolytic capacitors with solid (MnO_2) and non-solid electrolyte

Reference number
IEC 60384-4:2007(E)

Publication numbering

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International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE W

For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4: Sectional specification – Aluminium electrolytic capacitors with solid (MnO_2) and non-solid electrolyte

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International Standard IEC 60384-4 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This fourth edition cancels and replaces the third edition published in 1998 and its amendment 1 (2000). This edition constitutes a minor revision related to tables, figures and references.

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

CDV	Report on voting
40/1759/CDV	40/1819/RVC

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

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

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

The list of all parts of the IEC 60384 series, 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 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

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

The contents of the corrigendum of June 2007 have been included in this copy.

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4: Sectional specification – Aluminium electrolytic capacitors with solid (MnO_2) and non-solid electrolyte

1 General

1.1 Scope

This part of IEC 60384 applies to aluminium electrolytic capacitors with solid (MnO_2) and non-solid electrolyte primarily intended for d.c. applications for use in electronic equipment. It covers capacitors for long-life applications and capacitors for general-purpose applications.

Capacitors for special-purpose applications may need additional requirements.

Capacitors for fixed surface mount aluminium electrolytic capacitors are not included but they are covered by IEC 60384-18.

1.2 Object

The principal object of this standard is to prescribe preferred ratings and characteristics and to select from IEC 60384-1 the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements prescribed in detail specifications referring to this sectional specification shall be of equal or higher performance level, because lower performance levels are not permitted.

1.3 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 60063, *Preferred number series for resistors and capacitors*

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

IEC 60068-2-17, *Environmental testing – Part 2-17: Tests – Test Q: Sealing*

IEC 60068-2-54, *Environmental testing – Part 2-54: Tests – Test Ta: Solderability testing of electronic components by the wetting balance method*

IEC 60384-1:1999, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60384-4-1, *Fixed capacitors for use in electronic equipment – Part 4-1: Blank detail specification – Fixed aluminium electrolyte capacitors with non-solid electrolyte – Assessment level EZ*

IEC 60384-4-2, *Fixed capacitors for use in electronic equipment – Part 4-2: Blank detail specification – Fixed aluminium electrolyte capacitors with solid (MnO2) electrolyte – Assessment level EZ*

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

1.4 Information to be given in a detail specification

Detail specifications shall be derived from the relevant blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic, sectional or blank detail specification. When more severe requirements are included, they shall be listed in 1.9 of the detail specification and indicated in the test schedules, for example, by an asterisk.

NOTE The information given in 1.4.1 may, for convenience, be presented in tabular form.

The following information shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this sectional specification.

1.4.1 Outline drawing and dimensions

There shall be an illustration of the capacitor as an aid to easy recognition and for comparison of the capacitor with others.

Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification. All dimensions shall preferably be stated in millimeters; however, when the original dimensions are given in inches, the converted metric dimensions in millimetres shall be added.

Normally, the numerical values shall be given for the length of the body, the width and height of the body and the wire spacing, or for cylindrical types, the body diameter, and the length and diameter of the terminations. When necessary, for example, when a number of items (capacitance values/voltage ranges) are covered by a detail specification, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information as will adequately describe the capacitor. When the capacitor is not designed for use on printed boards, this shall be clearly stated in the detail specification.

1.4.2 Mounting

The detail specification shall specify the method of mounting to be applied for normal use and for the application of the vibration and the bump or shock tests. The capacitors shall be mounted by their normal means. The design of the capacitor may be such that special mounting fixtures are required in its use. In this case, the detail specification shall describe the mounting fixtures and they shall be used in the application of the vibration and bump or shock tests.

1.4.3 Ratings and characteristics

The ratings and characteristics shall be in accordance with the relevant clauses of this specification, together with the following.

1.4.3.1 Rated capacitance range

See 2.2.1.

NOTE When products approved to the detail specification have different ranges, the following statement should be added: "The range of values available in each voltage range is given in IEC QC 001005.".

1.4.3.2 Particular characteristics

Additional characteristics may be listed when they are considered necessary to specify adequately the component for design and application purposes.

1.4.3.3 Soldering

The detail specification shall prescribe the test methods, severities and requirements applicable for the solderability and the resistance to soldering heat test.

1.4.4 Marking

The detail specification shall specify the content of the marking on the capacitor and on the package. Deviations in 1.6 of this sectional specification shall be specifically stated.

1.5 Terms and definitions

For the purposes of this document, the following terms and definitions, in addition to the applicable terms and definitions of IEC 60384-1, apply.

1.5.1
capacitance of an electrolytic capacitor
capacitance of an equivalent circuit having capacitance and resistance in series measured with alternating current approximately sinusoidal waveform at a specified frequency

1.5.2
long-life grade capacitors
capacitors intended for applications where a high degree of stability of characteristics over a long life is essential. The materials are chosen and the manufacture carried out so that improved performance is obtained with consequent increase in life

1.5.3
general-purpose grade capacitors
capacitors intended for applications where the high performance level of long-life grade capacitors is not required

1.5.4
reverse voltage (for polar capacitors only)
voltage applied to the capacitor terminals in the reverse polarity direction

1.6 Marking

According to 2.4 of IEC 60384-1, with the following details.

1.6.1 The information given in the marking is normally selected from the following list; the relative importance of each item is indicated by its position in the list:

a) rated capacitance;

b) rated voltage (d.c. voltage may be indicated by the symbol: ⎓ or ⎓);

c) category voltage and category temperatures (for long-life grade capacitors only);

d) polarity of the terminations: for multi-section capacitors, the rated capacitance and rated voltage of the sections connected to each termination shall be shown in an unambiguous way. The termination of a capacitor section which is intended for direct connection to the rectifier (so-called reservoir section) shall be marked with the number 1 or with the colour red;

e) tolerance on rated capacitance;

f) reference to the grade (for long-life grade capacitors only). The abbreviation LL may be used for marking purposes;

g) year and month (or week) of manufacture;

h) manufacturer's name or trade mark;

i) climatic category;

j) manufacturer's type designation;

k) reference to the detail specification.

1.6.2 The capacitor shall be clearly marked with a), b), c), d), e) and f) above with as many as possible of the remaining items as is considered necessary. Any duplication of information in the marking on the capacitor should be avoided.

1.6.3 The package containing the capacitor(s) shall be clearly marked with all the information listed in 1.6.1.

1.6.4 Any additional marking shall be so applied that no confusion can arise.

2 Preferred ratings and characteristics

2.1 Preferred characteristics

The values given in detail specifications shall preferably be selected from the following.

2.1.1 Preferred climatic categories

The capacitors covered by this specification are classified into climatic categories according to the general rules given in IEC 60068-1.

The lower and upper category temperature and the duration of the damp-heat steady-state test shall be chosen from the following.

Lower category temperature:	–55 °C, –40 °C, –25 °C and –10 °C
Upper category temperature:	+85 °C, +100 °C, +105 °C and +125 °C
Duration of the damp-heat steady-state test:	10, 21 and 56 days

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

2.2 Preferred values of ratings

2.2.1 Rated capacitance (C_R)

Preferred values of rated capacitance are chosen from the E3 series of IEC 60063 and their decimal multiples.

If other values are needed, they shall preferably be chosen from the E6 series.

2.2.2 Tolerance on rated capacitance

Preferred values of tolerances on rated capacitance are:

–10/+10 %	–10/+75 %
–10/+30 %	–10/+100 %
–10/+50 %	–20/+20 %

2.2.3 Rated voltage (U_R)

Preferred values of rated direct voltages taken from the R5 and R10 series of ISO 3 are:

For voltage values <250 V: 1 V, 1,6 V, 2,5 V, 4 V, 6,3 V and their decimal multiples (R5 series), also 35 V, 50 V, 80 V and 200 V;

For voltage values ≥250 V: 250 V, 315 V, 350 V, 400 V, 450 V and 500 V (250 V, 315 V, 400 V and 500 V are in accordance with the R10 series; 350 V and 450 V are permitted in addition).

2.2.4 Category voltage (U_C)

The category voltage is equal to the rated voltage, unless otherwise stated in the detail specification.

2.2.5 Ripple voltage

An alternating voltage may be applied provided that the peak voltage resulting from the alternating voltage superimposed on the direct voltage does not exceed the value of rated direct voltage and that the rated ripple current (see 2.2.8) and the permissible reverse voltage (see detail specification) are not exceeded.

2.2.6 Reverse voltage

The permissible reverse voltage shall be given in the detail specification.

2.2.7 Surge voltage ratio

The surge voltage shall be 1,15 times the rated or category voltage for rated voltages ≤315 V or 1,10 times the rated or category voltage for rated voltages >315 V.

See also 4.14.

2.2.8 Rated ripple current

The rated ripple current at 100 Hz or 120 Hz and at upper category temperature shall be given in the detail specification. Alternatively, for capacitors for switched mode power supply application, the rated ripple current shall be stated at the relevant frequency.

NOTE This value is determined by the dimensions of the capacitor and several other factors, for example, the tangent of loss angle and the permissible temperature rise.

See also 2.2.5.