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Fixed Capacitors for Use in Electronic Equipment – Part 15: Sectional Specification – Fixed Tantalum Capacitors with Non- Solid or Solid Electrolyte

EIA-60384-15

October 2014



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This document is the EIA Standard EIA-60384-15 2014 Edition 1: *Fixed Capacitors for Use in Electronic Equipment – Part 15: Sectional Specification – Fixed Tantalum Capacitors with Non-Solid or Solid Electrolyte*.

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(From Standards Proposal No. 5278, formulated under the cognizance of the P-2.5 Committee on EIA Solid Electrolytic Capacitors Standards and given final approval by the Steering Committee for Passive Electronic Components Standards (S-1)).

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Numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series.

Consolidated publications

Consolidated versions of some IEC publications including amendments are available. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

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- **IEC web site***
- **Catalogue of IEC publications**
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- **IEC Bulletin**
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Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

- See web site address on title page.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT

Part 15: Sectional specification:
Fixed tantalum capacitors with non-solid or solid electrolyte

FOREWORD

- 1) The formal decisions or agreements of the I E C on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the I E C expresses the wish that all National Committees should adopt the text of the I E C recommendation for their national rules in so far as national conditions will permit. Any divergence between the I E C recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by I E C Technical Committee No. 40: Capacitors and Resistors for Electronic Equipment.

A draft was discussed at the meeting held in Nice in 1976. As a result of this meeting, a revised draft, Document 40(Central Office)462, was submitted to the National Committees for approval under the Six Months' Rule in May 1979.

The National Committees of the following countries voted explicitly in favour of publication:

Belgium	South Africa (Republic of)
Canada	Spain
Egypt	Sweden
Hungary	Switzerland
Italy	Turkey
Netherlands	United Kingdom
Norway	United States of America
Romania	

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

This standard replaces I E C Publication 361 (1971): Fixed Tantalum Capacitors with Liquid or Solid Electrolyte.

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT

Part 15: Sectional specification:
Fixed tantalum capacitors with non-solid or solid electrolyte

SECTION ONE -GENERAL

1. General

1.1 Scope

This standard applies to polar and bipolar tantalum electrolyte capacitors with solid and non-solid electrolyte for use in electronic equipment.

It comprises capacitors for long-life applications and capacitors for general-purpose applications. Capacitors for special purpose application may need additional requirements.

This standard covers three basic sub-families, namely:

Sub-family 1: Fixed non-solid electrolyte tantalum capacitors with foil electrode.

1A: Plain foil electrode.

1B: Etched foil electrode.

Sub-family 2: Fixed non-solid electrolyte tantalum capacitors with porous anode.

Sub-family 3: Fixed solid electrolyte tantalum capacitors with porous anode.

1.2 Object

The object of this standard is to prescribe preferred ratings and characteristics and to select from I E C Publication 384-1 (1982), 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 Related documents

I E C publications:

Publication 62 (1974): Marking Codes for Resistors and Capacitors.

Publication 63 (1963): Preferred Number Series for Resistors and Capacitors.
Amendment No. 1 (1967).
Amendment No.2 (1977).

Publication 68:	Basic Environmental Testing Procedures.
Publication 384-1 (1982):	Fixed Capacitors for Use in Electronic Equipment. Part I: Generic Specification.
Publication 410 (1973):	Sampling Plans and Procedures for Inspection by Attributes.
Publication QC 001001: Basic Rules of the I E C Quality Assessment System for (1981)	Electronic Components (IECQ).
Publication QC 001002: Rules of Procedure of the I E C Quality Assessment (1981)	System for Electronic Components (IECQ).

ISO Publication:

ISO Standard 3: Preferred Numbers-Series of Preferred Numbers.

Note. - The above references apply to the current editions except for I E C Publication 68, for which the referenced edition in the applicable test clauses of the generic specification shall be used.

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 Sub-clause 1.9 of the detail specification and indicated in the test schedules, for example by an asterisk.

Note. - The information given in Sub-clause 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 millimetres, however when the original dimensions are given in inches, the converted metric dimensions in millimetres shall 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 Rating 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 Sub-clause 2.2.1.

Note. - When products approved to the detail specification may have different ranges, the following statement should be added: "The range of values available in each voltage range is given in the qualified products list."

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 test 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 from Sub-clause 1.6 of this sectional specification, shall be specifically stated.

1.5 Terminology

In addition to the applicable terms and definitions of I E C Publication 384-1 the following definitions apply:

1.5.1 Capacitance of an electrolytic capacitor

The capacitance of an equivalent circuit having capacitance and resistance in series measured with alternating current of approximately sinusoidal waveform of the 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 so chosen and manufacture so carried out 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 Rated voltage (U_R)

The maximum direct voltage which may be applied continuously to the terminations of a capacitor at the rated temperature.

Note 1.- The sum of the direct voltage and the peak alternating voltage applied to the capacitor shall not exceed the rated voltage.

2.- For short periods, however, the rated voltage may be exceeded (see Sub-clauses 2.2.6 and 4.13).

1.6 Marking

According to Sub-clause 2.4 of I E C Publication 384-1, 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) (if applicable);
- d) polarity of the terminations:
polar capacitors shall be marked with a positive sign near the positive terminations. Bipolar capacitors shall be marked positive at both ends and, if space permits, in addition with the letters "BP";
- 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) indication of the sub-family (e.g. 1, 2 or 3);
- j) climatic category;
- k) manufacturer's type designation;
- l) reference to the detail specification.

1.6.2 The capacitor shall be clearly marked with a), b) and d) above and 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 Sub-clause 1.6.1.

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

SECTION TWO - PREFERRED RATINGS AND CHARACTERISTICS

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 I E C Publication 68-1.

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.

Upper category temperature: + 85 °C, + 100 °C and + 125 °C.

Duration of the damp heat, steady state test: 4, 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 I E C Publication 63 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:

Solid electrolyte capacitors	Non-solid electrolyte capacitors
± 5%	±10%
±10%	±20%
±20%	-10/+30%
	-10/+50%

2.2.3 Rated voltage (U_R)

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

1.0 - 1.6 - 2.5 - 4.0 - 6.3 and their decimal multiples.

If other values are required they shall preferably be chosen from the R10 series.

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 Reverse voltage

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

2.2.6 Surge voltage

The surge voltage shall be 1.15 times the rated or category voltage rounded off to the nearest volt.

2.2.7 Ripple (if applicable)

Ripple current and/or ripple voltage shall be specified in the detail specification.

2.2.8 Rated temperature

The value of the rated temperature is 85 °C unless otherwise stated in the detail specification.

SECTION THREE - QUALITY ASSESSMENT PROCEDURES

3. Quality assessment procedures**3.1 Primary Stage of Manufacture**

The primary stage of manufacture is the forming of the oxide.

3.2 Structurally Similar Components

Capacitors considered as being structurally similar are capacitors produced with similar processes and materials, though they may be of different case sizes and values.

3.3 Certified Records of Released Lots

The information required in Sub-clause 3.5.1 of I E C Publication 384-1 shall be made available when prescribed in the detail specification and when requested by a purchaser. After the endurance test, the parameters for which variables information is required are the capacitance change, $\tan \delta$ and the leakage current.