

INTERNATIONAL STANDARD

**Fixed capacitors for use in electronic equipment –
Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or
solid electrolyte**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

INTERNATIONAL STANDARD

**Fixed capacitors for use in electronic equipment –
Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or
solid electrolyte**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.060.40

ISBN 978-2-8322-4319-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	5
1 General	7
1.1 Scope	7
1.2 Object.....	7
1.3 Normative references.....	7
1.4 Information to be given in a detail specification	8
1.4.1 General	8
1.4.2 Outline drawing and dimensions	8
1.4.3 Mounting	8
1.4.4 Ratings and characteristics.....	8
1.4.5 Marking	9
1.5 Terms and definitions.....	9
1.6 Marking.....	9
1.6.1 General	9
1.6.2 Information for marking.....	10
1.6.3 Marking on capacitors.....	10
1.6.4 Marking on packaging.....	10
2 Preferred ratings and characteristics	10
2.1 Preferred characteristics	10
2.2 Preferred values of ratings	10
2.2.1 Nominal capacitance (C_N).....	10
2.2.2 Tolerance on nominal capacitance.....	11
2.2.3 Rated voltage (U_R)	11
2.2.4 Category voltage (U_C).....	11
2.2.5 Reverse voltage.....	11
2.2.6 Surge voltage (U_{RS} or U_{CS})	11
2.2.7 Ripple (if required).....	11
2.2.8 Rated temperature.....	12
3 Quality assessment procedures	12
3.1 Primary stage of manufacture	12
3.2 Structurally similar components	12
3.3 Certified test records of released lots.....	12
3.4 Qualification approval procedures.....	12
3.4.1 General	12
3.4.2 Qualification approval on the basis of the fixed sample size procedure	12
3.4.3 Tests	13
3.5 Quality conformance inspection	20
3.5.1 Formation of inspection lots.....	20
3.5.2 Test schedule	21
3.5.3 Delayed delivery.....	21
3.5.4 Assessment levels	21
4 Test and measurement procedures.....	22
4.1 Visual inspection and check of dimensions	22
4.2 Electrical tests	22
4.2.1 Leakage current.....	22
4.2.2 Capacitance	22
4.2.3 Tangent of loss angle ($\tan \delta$)	23

4.2.4	Impedance (if required).....	23
4.2.5	Insulation resistance of the external insulation (if required).....	24
4.2.6	Voltage proof of the external insulation (if required).....	24
4.3	Robustness of terminations.....	25
4.3.1	General	25
4.3.2	Initial inspection.....	25
4.3.3	Test Ua1, Ub and Uc applicable.....	25
4.3.4	Special bending test	25
4.4	Resistance to soldering heat.....	26
4.4.1	General	26
4.4.2	Conditions	26
4.4.3	Final inspections and requirements.....	26
4.5	Solderability.....	26
4.5.1	General	26
4.5.2	Test conditions	26
4.5.3	Final inspections and requirements.....	26
4.6	Rapid change of temperature	26
4.6.1	General	26
4.6.2	Initial inspection.....	27
4.6.3	Test conditions	27
4.6.4	Recovery	27
4.6.5	Final inspections and requirements.....	27
4.7	Vibration	27
4.7.1	General	27
4.7.2	Test condition	27
4.7.3	Final inspections and requirements.....	27
4.8	Bump	27
4.8.1	General	27
4.8.2	Mounting	28
4.8.3	Test conditions	28
4.8.4	Final inspections and requirements.....	28
4.9	Shock	28
4.9.1	General	28
4.9.2	Mounting	28
4.9.3	Test conditions	28
4.9.4	Final inspections and requirements.....	29
4.10	Climatic sequence.....	29
4.10.1	General	29
4.10.2	Initial inspection.....	29
4.10.3	Dry heat	29
4.10.4	Damp heat, cyclic, Test Db, first cycle	29
4.10.5	Cold.....	29
4.10.6	Low air pressure (if required).....	29
4.10.7	Damp heat, cyclic, Test Db, remaining cycles	29
4.10.8	Recovery	29
4.10.9	Sealing (if required)	30
4.10.10	Final inspections and requirements.....	30
4.11	Damp heat, steady state	30
4.11.1	General	30

4.11.2	Initial inspection.....	30
4.11.3	Final inspections and requirements.....	30
4.12	Endurance	30
4.12.1	General	30
4.12.2	Initial inspection.....	30
4.12.3	Test conditions	30
4.12.4	Recovery	31
4.12.5	Final inspections and requirements.....	31
4.13	Surge voltage	31
4.13.1	General	31
4.13.2	Initial inspection.....	31
4.13.3	Test conditions	31
4.13.4	Final inspections and requirements.....	31
4.14	Reverse voltage (if required).....	32
4.14.1	General	32
4.14.2	Initial inspection.....	32
4.14.3	Test conditions	32
4.14.4	Final inspections and requirements.....	32
4.15	Characteristics at high and low temperature.....	32
4.15.1	General	32
4.15.2	Final inspections and requirements.....	32
4.16	Charge and discharge (if required).....	32
4.16.1	General	32
4.16.2	Initial inspection.....	32
4.16.3	Test conditions	33
4.16.4	Recovery	33
4.16.5	Final inspections and requirements.....	33
4.17	Component solvent resistance	33
4.18	Solvent resistance of the marking	33
4.19	High surge current (if required)	33
4.19.1	General	33
4.19.2	Initial inspection.....	33
4.19.3	Final inspections and requirements.....	33
	Bibliography.....	34
	Figure 1 – Apparatus of special bending test	25
	Table 1 – Rated, category and surge voltages	11
	Table 2 – Sampling plan for qualification approval tests.....	14
	Table 3 – Test schedule for qualification approval	15
	Table 4 – Lot-by-Lot inspection.....	21
	Table 5 – Periodic Inspection.....	22
	Table 6 – Vibration test frequencies.....	27
	Table 7 – Shock peak acceleration/pulse duration	28
	Table 8 – Test temperature	31

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 International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60384-15 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This second edition cancels and replaces the first edition published in 1982, Amendment 1:1987 and Amendment 2:1992, and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Revision of the structure in accordance with ISO/IEC Directives, Part 2:2016 (seventh edition) to the extent practicable, and harmonization between other similar kinds of documents.
- b) In addition, Clause 4 and all the tables have been reviewed in order to prevent duplications and contradictions.

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

FDIS	Report on voting
40/2523/FDIS	40/2535/RVD

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

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

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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

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

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

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

1 General

1.1 Scope

This part of IEC 60384 applies to through-hole/leaded polar and bipolar tantalum electrolyte capacitors with solid and non-solid electrolyte for use in electronic equipment.

It includes capacitors for long-life applications and capacitors for general-purpose applications.

Capacitors for special purpose application may need additional requirements.

This document covers two basic sub-families:

- Sub-family 1: Fixed non-solid electrolyte tantalum capacitors with porous anode.
- Sub-family 2: Fixed solid electrolyte tantalum capacitors with porous anode.

1.2 Object

The object of this document is to prescribe preferred ratings and characteristics and to select from IEC 60384-1:2016 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 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 60063, *Preferred number series for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

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 60384-1:2016, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60417, *Graphical symbols for use on equipment*

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