

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fixed capacitors for use in electronic equipment –
Part 8: Sectional specification – Fixed capacitors of ceramic dielectric, Class 1**

**Condensateurs fixes utilisés dans les équipements électroniques –
Partie 8: Spécification intermédiaire – Condensateurs fixes à diélectrique en
céramique, Classe 1**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fixed capacitors for use in electronic equipment –
Part 8: Sectional specification – Fixed capacitors of ceramic dielectric, Class 1**

**Condensateurs fixes utilisés dans les équipements électroniques –
Partie 8: Spécification intermédiaire – Condensateurs fixes à diélectrique en
céramique, Classe 1**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.060.20

ISBN 978-2-8322-9520-5

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

| | |
|--|----|
| FOREWORD..... | 6 |
| 1 Scope..... | 8 |
| 2 Normative references | 8 |
| 3 Terms and definitions | 8 |
| 4 Preferred ratings and characteristics | 9 |
| 4.1 Preferred characteristics | 9 |
| 4.2 Preferred values of ratings | 9 |
| 4.2.1 Rated temperature | 9 |
| 4.2.2 Rated voltage (U_R) | 10 |
| 4.2.3 Category voltage (U_C)..... | 10 |
| 4.2.4 Preferred values of nominal capacitance and associated tolerance values..... | 10 |
| 4.2.5 Temperature coefficient (α)..... | 10 |
| 5 Test and measurement procedures..... | 15 |
| 5.1 General..... | 15 |
| 5.2 Visual examination and check of dimensions | 15 |
| 5.3 Electrical tests | 15 |
| 5.3.1 Capacitance | 15 |
| 5.3.2 Tangent of loss angle ($\tan \delta$) | 15 |
| 5.3.3 Insulation resistance (R_i)..... | 16 |
| 5.3.4 Voltage proof..... | 16 |
| 5.4 Temperature coefficient (α) and temperature cyclic drift of capacitance | 17 |
| 5.4.1 General | 17 |
| 5.4.2 Preliminary drying..... | 17 |
| 5.4.3 Measuring conditions..... | 17 |
| 5.4.4 Requirements | 17 |
| 5.5 Robustness of terminations..... | 18 |
| 5.6 Resistance to soldering heat..... | 18 |
| 5.6.1 General | 18 |
| 5.6.2 Initial measurement | 18 |
| 5.6.3 Test conditions | 18 |
| 5.6.4 Final inspection, measurements and requirements..... | 18 |
| 5.7 Solderability..... | 18 |
| 5.7.1 General | 18 |
| 5.7.2 Test conditions | 19 |
| 5.7.3 Final inspection, measurements and requirements..... | 19 |
| 5.8 Rapid change of temperature (if required)..... | 19 |
| 5.8.1 General | 19 |
| 5.8.2 Initial measurement | 19 |
| 5.8.3 Test conditions | 19 |
| 5.8.4 Recovery | 19 |
| 5.9 Vibration | 19 |
| 5.9.1 General | 19 |
| 5.9.2 Test conditions | 19 |
| 5.9.3 Final inspection, measurements and requirements..... | 19 |
| 5.10 Bump (repetitive shock) | 20 |

| | | |
|--------|--|----|
| 5.10.1 | General | 20 |
| 5.10.2 | Initial measurements | 20 |
| 5.10.3 | Test conditions | 20 |
| 5.10.4 | Final inspection, measurements and requirements..... | 20 |
| 5.11 | Shock (non-repetitive shock)..... | 20 |
| 5.11.1 | General | 20 |
| 5.11.2 | Initial measurements | 20 |
| 5.11.3 | Test conditions | 20 |
| 5.11.4 | Final inspection, measurements and requirements..... | 21 |
| 5.12 | Climatic sequence..... | 21 |
| 5.12.1 | General | 21 |
| 5.12.2 | Initial measurements | 21 |
| 5.12.3 | Dry heat | 21 |
| 5.12.4 | Damp heat, cyclic, Test Db, first cycle | 21 |
| 5.12.5 | Cold..... | 21 |
| 5.12.6 | Low air pressure | 22 |
| 5.12.7 | Damp heat, cyclic, Test Db, remaining cycles | 22 |
| 5.13 | Damp heat, steady state | 23 |
| 5.13.1 | General | 23 |
| 5.13.2 | Initial measurement | 23 |
| 5.13.3 | Test conditions | 23 |
| 5.13.4 | Recovery | 24 |
| 5.13.5 | Final inspection, measurements and requirements..... | 24 |
| 5.14 | Endurance | 24 |
| 5.14.1 | General | 24 |
| 5.14.2 | Initial measurement | 24 |
| 5.14.3 | Test conditions | 24 |
| 5.14.4 | Recovery | 25 |
| 5.14.5 | Final inspection, measurements and requirements..... | 25 |
| 5.15 | Component solvent resistance (if required) | 25 |
| 5.16 | Solvent resistance of the marking (if required) | 25 |
| 6 | Marking | 26 |
| 6.1 | General..... | 26 |
| 6.2 | Information for marking | 26 |
| 6.3 | Marking for code of temperature coefficient | 26 |
| 6.4 | Marking on the body | 26 |
| 6.5 | Marking of the packaging | 26 |
| 6.6 | Additional marking | 26 |
| 7 | Information to be given in a detail specification..... | 26 |
| 7.1 | General..... | 26 |
| 7.2 | Outline drawing and dimensions | 27 |
| 7.3 | Mounting..... | 27 |
| 7.4 | Ratings and characteristics | 27 |
| 7.4.1 | General | 27 |
| 7.4.2 | Nominal capacitance range..... | 27 |
| 7.4.3 | Particular characteristics | 27 |
| 7.4.4 | Soldering | 27 |
| 7.5 | Marking..... | 28 |
| 8 | Quality assessment procedures | 28 |

| | | |
|--|--|----|
| 8.1 | Primary stage of manufacture | 28 |
| 8.2 | Structurally similar components | 28 |
| 8.3 | Certified test records of released lots | 28 |
| 8.4 | Qualification approval | 28 |
| 8.4.1 | General | 28 |
| 8.4.2 | Qualification approval on the basis of the fixed sample size procedure | 28 |
| 8.4.3 | Tests | 29 |
| Annex A (informative) Figures with limits of variation of capacitance with temperature for certain temperature coefficients and classes..... | | 35 |
| Annex B (normative) Combination of temperature coefficients and tolerances for the reference temperature of 25 °C..... | | 43 |
| Annex C (normative) Quality conformance inspection | | 44 |
| C.1 | Formation of inspection lots | 44 |
| C.1.1 | Groups A and B inspection | 44 |
| C.1.2 | Group C inspection | 44 |
| C.2 | Test schedule | 44 |
| C.3 | Delayed delivery | 44 |
| C.4 | Assessment levels | 44 |
| C.5 | Test schedule for quality conformance inspection | 45 |
| Annex X (informative) Comparison of cross-references in relation to IEC 60384-8:2015 | | 51 |
| Bibliography..... | | 52 |
| | | |
| Figure A.1 – α : +100 ($10^{-6}/K$)..... | | 35 |
| Figure A.2 – α : 0 ($10^{-6}/K$) | | 36 |
| Figure A.3 – α : -33 ($10^{-6}/K$) | | 36 |
| Figure A.4 – α : -75 ($10^{-6}/K$) | | 37 |
| Figure A.5 – α : -150 ($10^{-6}/K$)..... | | 37 |
| Figure A.6 – α : -220 ($10^{-6}/K$)..... | | 38 |
| Figure A.7 – α : -330 ($10^{-6}/K$)..... | | 38 |
| Figure A.8 – α : -470 ($10^{-6}/K$)..... | | 39 |
| Figure A.9 – α : -750 ($10^{-6}/K$)..... | | 39 |
| Figure A.10 – α : -1 000 ($10^{-6}/K$)..... | | 40 |
| Figure A.11 – α : -1 500 ($10^{-6}/K$)..... | | 40 |
| Figure A.12 – α : -2 200 ($10^{-6}/K$)..... | | 41 |
| Figure A.13 – α : -3 300 ($10^{-6}/K$)..... | | 41 |
| Figure A.14 – α : -4 700 ($10^{-6}/K$)..... | | 42 |
| Figure A.15 – α : -5 600 ($10^{-6}/K$)..... | | 42 |
| | | |
| Table 1 – Preferred tolerances on nominal capacitance | | 10 |
| Table 2 – Nominal temperature coefficient and tolerance for reference temperature 20 °C | | 11 |
| Table 3 – Combination of temperature coefficient and tolerance | | 13 |
| Table 4 – Tangent of loss angle | | 15 |

| | |
|---|----|
| Table 5 – Insulation resistance requirements | 16 |
| Table 6 – Test voltages for single layer ceramic capacitors..... | 17 |
| Table 7 – Test voltages for leaded multilayer ceramic capacitors | 17 |
| Table 8 – Temperature cyclic drift limits | 18 |
| Table 9 – Requirements | 18 |
| Table 10 – Preferred severities (of non-repetitive shock) | 21 |
| Table 11 – Maximum capacitance change | 21 |
| Table 12 – Number of damp heat cycles | 22 |
| Table 13 – Final inspection, measurements and requirements | 23 |
| Table 14 – Test conditions for damp heat, steady state..... | 23 |
| Table 15 – Final inspection, measurements and requirements | 24 |
| Table 16 – Endurance test conditions | 25 |
| Table 17 – Final inspection, measurements and requirements | 25 |
| Table 18 – Sampling plan together with numbers of permissible non-conforming items for qualification approval tests, assessment level EZ | 30 |
| Table 19 – Test schedule for qualification approval..... | 31 |
| Table B.1 – Combination of temperature coefficients and tolerances for the reference temperature of 25 °C | 43 |
| Table C.1 – Lot-by-lot inspection | 45 |
| Table C.2 – Periodic tests..... | 45 |
| Table C.3 – Test schedule for quality conformance inspection (lot by lot)..... | 46 |
| Table C.4 – Test schedule for quality conformance inspection (Periodic test) | 47 |
| Table X.1 – Comparison of cross-references between this document and the previous edition of IEC 60384-8 for clauses/subclauses/annexes | 51 |
| Table X.2 – Reference to IEC 60384-8 for figure/table | 51 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**Part 8: Sectional specification –
Fixed capacitors of ceramic dielectric, Class 1**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60384-8 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2015. 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 ISO/IEC Directives, Part 2 and to make it more useable; tables, figures and references have been revised accordingly. Annex X contains all cross-references of changes in clause/subclause numbers.
- b) The terms have been replaced by the letter symbols in Table 3.

- c) Code of temperature coefficient and tolerance of C0G, U2J have been added in Table 4, Table 6, Table 8, Table 9, Table 11, Table 13, Table 16 and Annex B.
- d) Annex B has been changed from informative to normative.
- e) Clause C.5 (Test schedule for quality conformance inspection) has been newly added to withdraw the blank detail specification: IEC 60384-8-1.

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

| Draft | Report on voting |
|--------------|------------------|
| 40/3144/FDIS | 40/3161/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 60384 series, published 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.