



BSI Standards Publication

Application of fixed capacitors in electronic equipment

Part 1: Aluminium electrolytic capacitors

National foreword

This Published Document is the UK implementation of IEC TR 63362-1:2022.

The UK participation in its preparation was entrusted to Technical Committee W/-, Consumer Products and Services Sector Policy and Strategy Committee.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2022
Published by BSI Standards Limited 2022

ISBN 978 0 539 16582 1

ICS 31.060.50

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 August 2022.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------



TECHNICAL REPORT



Application of fixed capacitors in electronic equipment – Part 1: Aluminium electrolytic capacitors

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.060.50

ISBN 978-2-8322-1078-4

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

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Protection measures – insulation	8
5 General application limits	9
5.1 Polarity – Reverse voltage	9
5.2 Voltage	9
5.2.1 General	9
5.2.2 Rated voltage	9
5.2.3 Surge voltage	9
5.2.4 Transient voltages	9
5.3 Temperature range	9
5.4 Ripple current	10
5.5 Charge – Discharge	10
6 Storage, transportation, and operation.....	10
7 External pressure (not relevant for capacitors with solid electrolyte).....	11
7.1 Low air pressure	11
7.2 High air pressure	11
8 Self-recharge phenomenon (dielectric absorption).....	11
9 Flammability (passive and active).....	11
9.1 General.....	11
9.2 Passive flammability	11
9.3 Active flammability	12
10 Internal pressure and pressure relief device	12
11 Working electrolytes and contact with an electrolyte	12
12 Parallel and series connection of capacitors	13
12.1 General.....	13
12.2 Voltage sharing between devices	13
12.3 Circuit configuration.....	13
12.4 Balancing resistors for voltage sharing.....	14
12.4.1 General	14
12.4.2 Voltage sharing analysis.....	15
12.4.3 Resistor tolerance	16
12.4.4 Choice of resistor value	16
12.5 Component failure.....	17
13 Clearance and creepage distances	17
13.1 Distances inside the capacitor	17
13.2 Distances outside the capacitor	17
14 Capacitor mounting	18
14.1 General conditions for mounting	18
14.1.1 Mounting position	18
14.1.2 Polarity indication	18
14.1.3 Hole/pad distance.....	18
14.1.4 Position of the pressure relief device	18

14.1.5	Board holes under the insulation.....	19
14.1.6	Double-sided printed circuit boards.....	19
14.1.7	Case polarity	19
14.2	Component preparation.....	19
14.3	Mounting.....	19
14.3.1	Discharging	19
14.3.2	Ratings and polarity.....	19
14.3.3	Lead stress.....	19
14.3.4	Fixing torque	19
14.3.5	Capacitor fixing	20
14.4	Soldering	20
14.4.1	Preheat temperature	20
14.4.2	Soldering temperature and duration.....	20
14.4.3	Care after soldering	20
14.5	Transport and handling of assembled devices.....	20
15	Cleaning solvents and processes.....	20
15.1	General.....	20
15.2	Cleaning solvents	20
15.2.1	Halogenated solvents (e.g. CFC).....	20
15.2.2	Halogenated hydrocarbons	21
15.2.3	Aqueous solutions	21
15.2.4	Alcohols	21
15.2.5	Alkaline solvents.....	21
15.2.6	Other cleaning solvents	21
15.3	Cleaning of circuit board	21
15.3.1	Cleaning processes	21
15.3.2	Process control during cleaning.....	22
15.3.3	Process control after cleaning.....	22
15.3.4	Other precautions	22
16	Potting and gluing.....	22
16.1	General.....	22
16.2	Potting and gluing materials.....	23
16.3	Curing process.....	23
17	Selection of capacitors and failure mechanisms during overload.....	23
17.1	Selection.....	23
17.1.1	General	23
17.1.2	Selection based on operating conditions.....	23
17.1.3	Selection based on shapes and assembly conditions.....	23
17.2	Failure mechanisms during overload (especially details under overvoltage load conditions)	24
17.2.1	Overview	24
17.2.2	Failure mechanisms - details	24
18	Disposal of capacitors	25
	Bibliography.....	26
	Figure 1 – Individual balancing resistors	13
	Figure 2 – Common centre connection.....	14
	Figure 3 – Group-balancing resistors	14

Figure 4 – Voltage sharing analysis	15
Figure 5 – Degradation mechanisms	24
Table 1 – Balancing examples	17

INTERNATIONAL ELECTROTECHNICAL COMMISSION

APPLICATION OF FIXED CAPACITORS IN ELECTRONIC EQUIPMENT –

Part 1: Aluminium electrolytic capacitors

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.

IEC TR 63362-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is a Technical Report.

This first edition cancels and replaces CLC/TR 50454 published in 2008. This edition constitutes a technical revision.

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

- a) Complete technical revision, details of cleaning processes and failure modes added.
- b) Inclusion of parts of JEITA RCR 2367D.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
40/2881/DTR	40/2908/RVDTR

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 Technical Report is English.

A list of all parts in the IEC 63362 series, published under the general title *Application of fixed capacitors in electronic equipment*, can be found on the IEC website.

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/standardsdev/publications.

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

APPLICATION OF FIXED CAPACITORS IN ELECTRONIC EQUIPMENT –

Part 1: Aluminium electrolytic capacitors

1 Scope

This document establishes guidelines for the application and use of aluminium electrolytic capacitors in electronic equipment.

The information given in this document applies to capacitors with non-solid electrolyte but can, in its appropriate clauses, apply to capacitors with solid electrolyte as well.

Electrolytic capacitors in general – and aluminium electrolytic capacitors in particular – are an exception in the capacitor field because of the components' close interaction of physics and chemistry. Therefore, aluminium electrolytic capacitors show, in various aspects, a technical behaviour unaccustomed to the user. That could easily lead to misapplications and even to endangering of persons and goods. The aim of this document is to minimize these risks by providing detailed information on the specific peculiarities of the component.

2 Normative references

There are no normative references in this document.

NOTE Further information about related standards can be found in Bibliography at the end of this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1

anode

positive electrode

aluminium (preferably aluminium foil) of extreme purity that is etched in most cases in order to increase the electrode's surface and, consequently, the capacitor's capacitance yield

3.2

cathode

negative electrode

working electrolyte that is a conductive material

Note 1 to entry: Working electrolyte in the case of capacitors with solid electrolyte is a layer of manganese dioxide MnO_2 , conductive organic salt (e.g. TCNQ) or conductive polymer (e.g. polypyrrole, PEDOT).

Note 2 to entry: PEDOT is a thiophene-based doped polymer, which is used as a solid cathode in aluminium electrolytic capacitors, often combined with an additional liquid electrolyte.