

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fixed capacitors for use in electronic equipment –
Part 3: Sectional specification – Surface mount fixed tantalum electrolytic
capacitors with solid (MnO₂) electrolyte**

**Condensateurs fixes utilisés dans les équipements électroniques –
Partie 3: Spécification intermédiaire – Condensateurs fixes électrolytiques
au tantale pour montage en surface, à électrolyte solide (MnO₂)**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2016 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 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 15 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.

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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

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 aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

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

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fixed capacitors for use in electronic equipment –
Part 3: Sectional specification – Surface mount fixed tantalum electrolytic
capacitors with solid (MnO₂) electrolyte**

**Condensateurs fixes utilisés dans les équipements électroniques –
Partie 3: Spécification intermédiaire – Condensateurs fixes électrolytiques
au tantale pour montage en surface, à électrolyte solide (MnO₂)**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.060.30

ISBN 978-2-8322-3508-9

**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.....	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.....	9
1.6.3 Marking on capacitors.....	9
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 Surge voltage (U_{RS} or U_{CS}).....	11
2.2.6 Rated temperature.....	11
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.....	20
3.5.3 Delayed delivery.....	20
3.5.4 Assessment levels.....	20
4 Test and measurement procedures.....	21
4.1 Drying.....	22
4.2 Measuring conditions.....	22
4.3 Mounting.....	22
4.3.1 General.....	22
4.3.2 Initial inspection.....	22
4.3.3 Final inspections.....	22

4.4	Visual examination and check of dimensions	22
4.4.1	General	22
4.4.2	Visual examination and check of dimensions	22
4.4.3	Requirements	22
4.5	Electrical tests	22
4.5.1	Leakage current	22
4.5.2	Capacitance	23
4.5.3	Tangent of loss angle ($\tan \delta$)	23
4.5.4	Impedance (if required)	23
4.5.5	Equivalent series resistance (ESR) (if required)	24
4.6	Resistance to soldering heat	24
4.6.1	General	24
4.6.2	Test conditions	24
4.6.3	Recovery	24
4.6.4	Final inspections and requirements	25
4.7	Solderability	25
4.7.1	General	25
4.7.2	Test conditions	25
4.7.3	Final inspections and requirements	25
4.8	Shear test	25
4.8.1	General	25
4.8.2	Final inspections and requirements	25
4.9	Substrate bending test	25
4.9.1	General	25
4.9.2	Final inspections and requirements	25
4.10	Rapid change of temperature	25
4.10.1	General	25
4.10.2	Initial inspection	25
4.10.3	Test conditions	25
4.10.4	Recovery	26
4.10.5	Final inspections and requirements	26
4.11	Climatic sequence (if required)	26
4.11.1	General	26
4.11.2	Initial inspections	26
4.11.3	Dry heat	26
4.11.4	Damp heat, cyclic, test Db, first cycle	26
4.11.5	Cold	26
4.11.6	Damp heat, cyclic, test Db, remaining cycles	26
4.11.7	Recovery	26
4.11.8	Final inspections and requirements	26
4.12	Damp heat, steady state (if required)	26
4.12.1	General	26
4.12.2	Initial inspections	27
4.12.3	Test conditions	27
4.12.4	Recovery	27
4.12.5	Final inspections and requirements	27
4.13	Characteristics at high and low temperature	27
4.13.1	General	27
4.13.2	Inspections and requirements	27

4.14	Surge voltage.....	27
4.14.1	General	27
4.14.2	Initial inspections	27
4.14.3	Test conditions	27
4.14.4	Recovery	28
4.14.5	Final inspections and requirements	28
4.15	Endurance	28
4.15.1	General	28
4.15.2	Initial inspections	28
4.15.3	Test conditions	28
4.15.4	Recovery	28
4.15.5	Final inspections and requirements	29
4.16	Reverse voltage (if required)	29
4.16.1	Initial inspections	29
4.16.2	Test conditions	29
4.16.3	Recovery	29
4.16.4	Final inspections and requirements	29
4.17	Component solvent resistance (if required)	29
4.18	Solvent resistance of the marking (if required)	29
4.19	High surge current (if required).....	29
Bibliography	30
<p>ITeH STANDARD PREVIEW (standards.iteh.ai)</p>		
Table 1	– Letter code and digit.....	10
Table 2	– Category voltages and surge voltages.....	11
Table 3	– Sampling plan for qualification approval, assessment level EZ.....	14
Table 4	– Test schedule for qualification approval	15
Table 5	– Lot-by-lot inspection	21
Table 6	– Periodic inspection	21
Table 7	– Test temperatures	28

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**Part 3: Sectional specification – Surface mount fixed tantalum electrolytic capacitors with solid (MnO₂) 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 60384-3 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 2006 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 2:2011 (sixth 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 standard is based on the following documents:

FDIS	Report on voting
40/2464/FDIS	40/2470/RVD

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 list of all the 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 stability date indicated on the IEC website 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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 60384-3:2016](#)

<https://standards.iteh.ai/catalog/standards/sist/fd6e52ab-52f3-4aa2-846f-e8eaa7ad0fdb/iec-60384-3-2016>

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 3: Sectional specification – Surface mount fixed tantalum electrolytic capacitors with solid (MnO₂) electrolyte

1 General

1.1 Scope

This part of IEC 60384 applies to fixed tantalum electrolytic surface mount capacitors with solid (MnO₂) electrolyte primarily intended for d.c. applications for use in electronic equipment.

These capacitors are primarily intended for use in electronic equipment to be mounted directly on substrates for hybrid circuits or to printed boards.

Capacitors for special-purpose applications may need additional requirements.

The following two styles are considered:

- Style 1: Capacitors protected with external materials;
- Style 2: Capacitors unprotected with external materials.

1.2 Object

The object of this standard 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 should be of equal or higher performance level, because lower performance levels are not permitted.

1.3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60062, *Marking codes for resistors and capacitors*

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

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

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*

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

1.4 Information to be given in a detail specification

1.4.1 General

Detail specifications shall be derived from the 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.

The information given in 1.4.2 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.

1.4.2 Outline drawing and dimensions

There shall be an illustration of the capacitors as an aid to easy recognition and for comparison of the capacitors 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 be added.

The numerical values on the body shall be given as follows:

- general: width, length and height.

The numerical values on the terminals shall be given as follows:

- terminals: width, length and spacing.

When a number of case sizes 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.

1.4.3 Mounting

The method of mounting for tests and measurements are given in 4.3. The detail specification shall specify the methods of mounting for normal use.

1.4.4 Ratings and characteristics

1.4.4.1 General

The ratings and characteristics shall be given in accordance with the relevant clauses of this specification, including the items as specified below.

1.4.4.2 Nominal capacitance range

See 2.2.1.

When products approved to the detail specification have different nominal capacitance ranges, the following statement should be added:

"The nominal capacitance range available in each voltage range is given in the register of approvals, available for example on the IECQ on-line certificate system website www.iecq.org".

1.4.4.3 Particular characteristics

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

1.4.4.4 Soldering

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

1.4.5 Marking

The detail specification shall specify the content of the marking on the capacitor and on the packaging. Any deviations from 1.6 shall be stated in the detail specification.

1.5 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60384-1:2016, as well as the following apply.

1.5.1 capacitance

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

[IEC 60384-3:2016](https://standards.iteh.ai/catalog/standards/sist/fd6e52ab-52f3-4aa2-846f-e8eaa7ad0fdb/iec-60384-3-2016)

1.6 Marking

<https://standards.iteh.ai/catalog/standards/sist/fd6e52ab-52f3-4aa2-846f-e8eaa7ad0fdb/iec-60384-3-2016>

1.6.1 General

See IEC 60384-1:2016, 2.4, with the following details.

1.6.2 Information for marking

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) polarity of the terminations (unless identified by the construction);
- b) nominal capacitance;
- c) rated voltage (d.c. voltage may be indicated by the symbol: $\overline{\text{---}}$ (IEC 60417-5031:2002) or ---);
- d) tolerance on nominal capacitance;
- e) year and month (or, year and week) of manufacture;
- f) manufacturer's name and/or trade mark;
- g) manufacturer's type designation;
- h) reference to the detail specification.

1.6.3 Marking on capacitors

Polarity of the terminations shall be marked. Others are marked as necessary.

Any marking shall be legible and not easily smeared or removed by rubbing with the finger.

Where space does not permit the marking of the capacitor in accordance with IEC 60062 the following code may be used.

a) Capacitance coding

The nominal capacitance value code in picofarad is given in Table 1.

Table 1 – Letter code and digit

Letter	Value	Digit	Multiplier
A	1,0	9	10 ⁻¹
C	1,2	0	10 ⁰
E	1,5	1	10 ¹
G	1,8	2	10 ²
J	2,2	3	10 ³
L	2,7	4	10 ⁴
N	3,3	5	10 ⁵
Q	3,9	6	10 ⁶
S	4,7	7	10 ⁷
U	5,6	8	10 ⁸
W	6,8		
Y	8,2		

NOTE In Table 1 the capacitance is indicated in picofarad, given as the reference standard. The nominal capacitance value is indicated in microfarad (µF) according to 2.2.1.

b) Voltage coding

For code letters for marking, see the detail specification.

1.6.4 Marking on packaging

The packaging containing the capacitors should be clearly marked with all the information listed in 1.6.2 as necessary.

2 Preferred ratings and characteristics

2.1 Preferred characteristics

Preferred climatic categories shall only be given in the preferred characteristics.

The capacitors covered by this specification are classified into climatic categories according to the general rules given in IEC 60068-1:2013, Annex A.

The lower and upper category temperature shall be taken from the following:

- lower category temperature: –55 °C;
- upper category temperature: +85 °C and +125 °C.

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

2.2 Preferred values of ratings

2.2.1 Nominal capacitance (C_N)

Preferred values of nominal capacitance are indicated in microfarad (µF).

Preferred values of nominal capacitance shall be taken from the E6 series of IEC 60063, as follows:

1,0 – 1,5 – 2,2 – 3,3 – 4,7 – 6,8;

and their decimal multiples ($\times 10^n$, n : integer).

2.2.2 Tolerance on nominal capacitance

Preferred values of tolerances on nominal capacitance are:

–10 % to +10 % and –20 % to +20 %.

2.2.3 Rated voltage (U_R)

The preferred values of rated d.c. voltages taken from the R 10 and R 20 series of ISO 3 are:

- from R 10: +1,0 – 1,25 – 1,6 – 2,0 – 2,5 – 3,15 – 4,0 – 5,0 – 6,3 – 8,0;
- from R 20: +3,5¹ – 4,5;

and their decimal multiples ($\times 10^n$, n : integer).

2.2.4 Category voltage (U_C)

The category voltages for capacitors having an upper category temperature of +125 °C are given in Table 2.

2.2.5 Surge voltage (U_{RS} or U_{CS}) IEC 60384-3:2016

The surge voltage shall be given in Table 2.

NOTE U_{RS} is the surge voltage to rated voltage.

U_{CS} is the surge voltage to category voltage.

Table 2 – Category voltages and surge voltages

Dimensions in volt

U_R	2,5	4	6,3	10	16	20	25	35	40	50	63	100
U_C	1,6	2,5	4,0	6,3	10	13	16	22	25	32	40	63
U_{RS}	3,3	5,2	8,0	13	20	26	33	46	52	65	80	130
U_{CS}	2,0	3,3	5,2	8,0	13	16	20	29	33	42	52	80

2.2.6 Rated temperature

The standard value of the rated temperature is +85 °C, unless otherwise specified in the detail specification.

¹ ISO 3 indicates the value 3,55 for R 20.

3 Quality assessment procedures

3.1 Primary stage of manufacture

For capacitors with solid electrolyte, the primary stage of manufacture is the formation of the anode body.

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 test records of released lots

The information required in IEC 60384-1:2016, Q.1.5 shall be made available when prescribed in the detail specification and when requested by a purchaser. After the endurance test, the required parameters are the capacitance change, tangent of loss angle and the leakage current.

3.4 Qualification approval procedures

3.4.1 General

The procedures for qualification approval testing are given in IEC 60384-1:2016, Clause Q.2.

The schedule to be used for qualification approval testing on the basis of lot-by-lot and periodic tests is given in 3.5. The procedure using a fixed sample size schedule is given in 3.4.2 and 3.4.3.

3.4.2 Qualification approval on the basis of the fixed sample size procedure

The fixed sample size procedure is described in IEC 60384-1:2016, Q.2.4. The sample shall be representative of the range of capacitors for which approval is sought. The samples may be the whole or part of the range given in the detail specification.

The sample shall consist of four specimens having the maximum and minimum voltages and, for these voltages, the maximum and minimum case size. When there are more than four case sizes, an intermediate case size shall also be tested. In each of these case size/voltage combinations (values), the maximum capacitance shall be chosen. Thus, for the approval of a range, testing is required of either four or six values. When the range consists of less than four values, the number of specimens to be tested shall be that required for four values.

Two (for 6 values) or three (for 4 values) per value may be used as replacements for specimens, which are non-conforming because of incidents not attributable to the manufacturer.

The numbers given in Group 0 assume that all groups are applicable. If this is not so, the numbers may be reduced accordingly.

When additional groups are introduced into the qualification approval test schedule, the number of specimens required for Group 0 shall be increased by the same number as that required for the additional groups.

Table 3 gives the number of samples to be tested in each group or subgroup together with the permissible number of non-conforming items for qualification approval tests.

3.4.3 Tests

The complete series of tests specified in Table 3 and Table 4 are required for the approval of capacitors covered by one detail specification. The tests of each group shall be carried out in the order given.

The whole sample shall be subjected to the tests of Group 0 and then divided for the other groups.

Specimens found to be non-conforming in the tests of Group 0 shall not be used for the other groups.

Approval is granted when the number of non-conforming items is zero.

Table 3 and Table 4 together form the fixed sample size test schedule for the qualification approval on the basis of the fixed sample size procedure.

Table 3 gives the number of the samples and permissible non-conforming items for each test or test groups.

Table 4 gives a summary of the test conditions and performance requirements, and choices of the test conditions and performance requirements in the detail specification.

The test conditions and performance requirements for the qualification approval on the basis of the fixed sample size procedure should be identical to those for quality conformance inspection given in the detail specification.