

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

QC 302300

**Fixed capacitors for use in electronic equipment –  
Part 18: Sectional specification – Fixed aluminium electrolytic surface mount  
capacitors with solid ( $\text{MnO}_2$ ) and non-solid electrolyte**

**Condensateurs fixes utilisés dans les équipements électroniques –  
Partie 18: Spécification intermédiaire – Condensateurs fixes électrolytiques à  
l'aluminium pour montage en surface à électrolyte solide ( $\text{MnO}_2$ ) et non solide**

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**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –****Part 18: Sectional specification –  
Fixed aluminium electrolytic surface mount capacitors  
with solid (MnO<sub>2</sub>) and non-solid electrolyte**

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International Standard IEC 60384-18 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 1993 and its Amendment 1 (1998). This edition constitutes a minor revision related to tables, figures and references.

This bilingual version, published in 2008-07, corresponds to the English version.

The text of this standard is based on the following documents:

CDV	Report on voting
40/1764/CDV	40/1822/RVC

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

The French version of this standard has not been voted upon.

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

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

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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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## FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

### Part 18: Sectional specification – Fixed aluminium electrolytic surface mount capacitors with solid (MnO<sub>2</sub>) and non-solid electrolyte

#### 1 General

##### 1.1 Scope

This part of IEC 60384 applies to fixed aluminium electrolytic surface mount capacitors with solid (MnO<sub>2</sub>) and non-solid electrolyte primarily intended for d.c. applications for use in electronic equipment.

##### 1.2 Object

The object of this standard is to prescribe preferred ratings and characteristics and to select from IEC 60384-1 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 referenced documents are indispensable for the application 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, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-58:2004, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60384-1:1999, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60384-18-1, *Fixed capacitors for use in electronic equipment – Part 18-1: Blank detail specification – Fixed aluminium electrolytic surface mount capacitors with solid (MnO<sub>2</sub>) electrolyte – Assessment level EZ*

IEC 60384-18-2, *Fixed capacitors for use in electronic equipment – Part 18-2: Blank detail specification – Fixed aluminium electrolytic surface mount capacitors with non-solid electrolyte – Assessment level EZ*

IEC 60410, *Sampling plans and procedures for inspection by attributes*

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



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

NOTE The information given in 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 be 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 Ratings 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 2.2.1.

NOTE When products approved to the detail specification have different ranges, the following statement should be added: "The range of values available in each voltage range is given in IECQ 001005".

#### 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 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 in 1.6 of this sectional specification shall be specifically stated.

## 1.5 Terms and definitions

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

### 1.5.1

#### capacitance of an electrolytic capacitor

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

### 1.5.2

#### surface mount capacitor

capacitor whose small dimensions or nature or shape of terminations make it suitable for surface mounting in hybrid circuits and printed boards.

### 1.5.3

#### reverse voltage (for polar capacitors only)

voltage applied to the capacitor terminals in the reverse polarity direction

## 1.6 Marking

According to 2.4 of IEC 60384-1, 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) polarity of the terminations (unless identified by the construction)
- b) rated capacitance;
- c) rated voltage (d.c. voltage may be indicated by the symbol:  $\text{---}$  or  $\text{—}$ );
- d) tolerance on rated capacitance;
- e) reference to the grade (in accordance with 1.1);
- f) year and month (or week) of manufacture;
- g) manufacturer's name or trade mark;
- h) climatic category;
- i) manufacturer's type designation;
- j) reference to the detail specification.

**1.6.2** Surface mount capacitors are generally not marked on the body. If some marking can be applied, they shall be clearly marked with as many as possible of the remaining items as is considered useful. Any duplication of information in the marking on the capacitor should be avoided.

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

**1.6.4** The package containing the capacitor(s) shall be clearly marked with all the information listed in 1.6.1, except polarity, unless this is applicable to the method of packing.

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

## **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 IEC 60068-1.

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:  $-55\text{ °C}$ ,  $-40\text{ °C}$ ,  $-25\text{ °C}$  and  $-10\text{ °C}$ .

Upper category temperature:  $+85\text{ °C}$ ,  $+100\text{ °C}$ ,  $+105\text{ °C}$  and  $+125\text{ °C}$ .

Duration of the damp-heat, steady-state test: 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 E6 series of IEC 60063 and their decimal multiples.

#### **2.2.2 Tolerance on rated capacitance**

Preferred values of tolerances on rated capacitance are:

$-10 / +10\%$  and  $-20 / +20\%$

#### **2.2.3 Rated voltage ( $U_R$ )**

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

1,0 V, 1,6 V, 2,5 V, 4,0 V, 6,3 V and their decimal multiples

If other values are required, they shall preferably be chosen from the R10 series of ISO 3.

Also 35 V is preferred.

#### **2.2.4 Category voltage ( $U_C$ )**

For capacitors having an upper category temperature of  $125\text{ °C}$ , category voltages are given in Table 1.

**Table 1 – Category voltages**

$U_R$ (V)	2,5	4	6,3	10	16	25	40	63
$U_C$ (V)	1,6	2,5	4	6,3	10	16	25	40

**2.2.5 Surge voltage**

The surge voltage shall be 1,15 times the rated or category voltage, rounded off to the nearest volt.

**2.2.6 Rated temperature**

The value of the rated temperature is 85 °C, 100 °C, 105 °C or 125 °C.

**3 Quality assessment procedures****3.1 Primary stage of manufacture**

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

For capacitors with non-solid electrolyte, the primary stage of manufacture is the capacitor manufacturer's evaluation of the formed anode foil.

**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 3.9 of IEC 60384-1 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.

**3.4 Qualification approval procedures**

The procedures for qualification approval testing are given in 3.5 of the generic specification, IEC 60384-1.

The schedule to be used for qualification approval testing on the basis of lot-by-lot and periodic tests is given in 3.5 of this specification. The procedure using a fixed sample size schedule is given in 3.4.1 and 3.4.2 below.

**3.4.1 Qualification approval on the basis of the fixed sample size procedure***Sampling*

The fixed sample size procedure is described in 3.5.3b) of IEC 60384-1. The sample shall be representative of the range of capacitors for which approval is sought. This may or may not be the complete range covered by the detail specification.

The sample shall consist of specimens having the lowest and highest voltages and for these voltages the smallest and largest 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 highest 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.

Spare specimens are permitted as follows:

- a) one per value which may be used to replace the permitted nonconforming item in Group 0;
- b) one per value which may be used as replacements for specimens which are nonconforming 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 2 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.

### 3.4.2 Tests

The complete series of tests specified in Tables 2 and 3 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 nonconforming during the tests of Group 0 shall not be used for the other groups.

"One nonconforming item" is counted when a capacitor has not satisfied the whole or part of the tests of a group.

The approval is granted when the number of nonconforming items does not exceed the specified number of permissible nonconforming items for each group or subgroup and the total number of permissible nonconforming items.

NOTE Tables 2 and 3 together form the fixed sample size test schedule, for which Table 2 includes the details for the sampling and permissible nonconforming items for the different tests or groups of tests, whereas Table 3, together with the details of tests contained in Clause 4, gives a complete summary of test conditions and performance requirements and indicates where, for example, for the test method or conditions of test, a choice is made in the detail specification.

The conditions of test and performance requirements for the fixed sample size test schedule should be identical to those prescribed in the detail specification for quality conformance inspection.

**Table 2 – Sampling plan for qualification approval, assessment level EZ**

Group No.	Test	Subclause of this publication	Number of specimens <i>n</i> <sup>d</sup>	Permissible number of non-conforming items <sup>c</sup>			
0	High surge current <sup>b</sup>	4.22	112+8	0			
	Visual examination	4.4					
	Dimensions	4.4					
	Leakage current	4.5.1					
	Capacitance	4.5.2					
	Tangent of loss angle	4.5.3					
	Impedance <sup>c</sup>	4.5.4					
	Spare specimens	16					
1A	Resistance to soldering heat	4.6	12	0			
	Component solvent resistance <sup>c</sup>	4.20					
1B	Solderability	4.7	12	0			
	Solvent resistance of the marking <sup>c</sup>	4.21					
2	Substrate bending test	4.9	12	0			
3 <sup>a</sup>	Mounting	4.3	84	0 <sup>e</sup>			
	Visual examination	4.4					
	Leakage current	4.5.1					
	Capacitance	4.5.2					
	Tangent of loss angle	4.5.3					
	Impedance <sup>c</sup>	4.5.4					
	3.1	Shear test			4.8	20	0
		Rapid change of temperature			4.10		
Climatic sequence		4.11					
3.2	Damp heat, steady state	4.12	20	0			
3.3A	Characteristics at high and low temperature	4.13	8	0			
	Charge and discharge <sup>c</sup>	4.19					
3.3B	Reverse voltage <sup>c</sup>	4.16	8	0			
3.4	Endurance	4.15	20	0			
3.5	Storage at high temperature	4.17	8				
	Storage at low temperature <sup>c</sup>	4.18					
	Surge	4.14					

<sup>a</sup> The value of these measurements serve as initial measurements for the tests of subgroups 3.

<sup>b</sup> For solid electrolyte capacitors only, if prescribed by the detail specification.

<sup>c</sup> If required by the detail specification.

<sup>d</sup> For case size/ voltage combinations, see 3.4.1

<sup>e</sup> The capacitors found nonconforming after mounting shall not be taken into account when calculating the nonconforming items for the following tests. They shall be replaced by spare capacitors.