

# INTERNATIONAL STANDARD

**IEC**  
**60384-25-1**

First edition  
2006-06

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**Fixed capacitors for use in electronic equipment –**

**Part 25-1:**

**Blank detail specification –**

**Surface mount fixed aluminium electrolytic  
capacitors with conductive polymer solid  
electrolyte – Assessment level EZ**



Reference number  
IEC 60384-25-1:2006(E)

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#### **Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte – Assessment level EZ**

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**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –****Part 25-1: Blank detail specification – Surface mount fixed aluminum electrolytic capacitors with conductive polymer solid electrolyte –  
Assessment level EZ**

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

FDIS	Report on voting
40/1734/FDIS	40/1757/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.

IEC 60384 consists of the following parts, under the general title *Fixed capacitors for use in electronic equipment*:

- Part 1: Generic specification
- Part 2: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric d.c. capacitors
- Part 3: Sectional specification: Fixed tantalum chip capacitors
- Part 4: Sectional specification: Aluminium electrolytic capacitors with solid and non-solid electrolyte
- Part 5: Sectional specification: Fixed mica dielectric d.c. capacitors with a rated voltage not exceeding 3 000 V – Selection of methods of test and general requirements
- Part 6: Sectional specification: Fixed metallized polycarbonate film dielectric d.c. capacitors
- Part 7: Sectional specification: Fixed polystyrene film dielectric metal foil d.c. capacitors
- Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1
- Part 9: Sectional specification: Fixed capacitors of ceramic dielectric, Class 2
- Part 11: Sectional specification: Fixed polyethylene-terephthalate film dielectric metal foil d.c. capacitors
- Part 12: Sectional specification: Fixed polycarbonate film dielectric metal foil d.c. capacitors
- Part 13: Sectional specification: Fixed polypropylene film dielectric metal foil d.c. capacitors
- Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains
- Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte
- Part 16: Sectional specification: Fixed metallized polypropylene film dielectric d.c. capacitors
- Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors
- Part 18: Sectional specification: Fixed aluminium electrolytic chip capacitors with solid and non-solid electrolyte
- Part 19: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric chip d.c. capacitors
- Part 20: Sectional specification: Fixed metallized polyphenylene sulphide film dielectric chip d.c. capacitors
- Part 21: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1
- Part 22: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2
- Part 23: Sectional specification: Fixed surface mount metallized polyethylene naphthalate film dielectric d.c. capacitors
- Part 24: Sectional specification: Surface mount fixed tantalum electrolytic capacitors with conductive polymer solid electrolyte
- Part 25: Sectional specification: Surface mount fixed aluminium electrolyte capacitors with conductive polymer solid electrolyte

All sectional specifications mentioned above do have one or more blank detail specifications being a supplementary document, containing requirements for style, layout and minimum content of detail specifications.

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

- 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 25-1: Blank detail specification – Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte – Assessment level EZ**

#### **Blank detail specification**

A blank detail specification is a supplementary document to the sectional specification and contains requirements for style, layout and minimum content of detail specifications. Detail specifications not complying with these requirements may not be considered as being in accordance with IEC specifications nor shall they so be described.

In the preparation of detail specifications the content of 1.4 of the sectional specification shall be taken into account.

The numbers between square brackets on the first page of the detail specification correspond to the following information, which shall be inserted in the position indicated.

#### **Identification of the detail specification**

- [1] The "International Electrotechnical Commission" or the National Standards Organization under whose authority the detail specification is drafted.
- [2] The IEC or National Standards number of the detail specification, date of issue and any further information required by the national system.
- [3] The number and issue number of the IEC or national generic specification.
- [4] The IEC number of the blank detail specification.

#### **Identification of the capacitor**

- [5] A short description of the type of capacitor.
- [6] Information on typical construction (when applicable).
- [7] Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the national or international documents for outlines. Alternatively, this drawing may be given in an annex to the detail specification.
- [8] Application or group of applications covered and/or assessment level.
- [9] Reference data on the most important properties, to allow comparison between the various capacitor types.

	[1]		[2]
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH:	[3]	IEC 60384-25-1	[4]
Outline drawing : (see Table 1) (...angle projection)	[7]	Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte	[5]
			[6]
		Assessment level(s): EZ	[8]

Information on the availability of components qualified to  
this detail specification is given in EC QC 001005.

[9]

## 1 General data

### 1.1 Recommended method(s) of mounting (to be inserted)

(See 1.4.2 of IEC 60384-25).

### 1.2 Dimensions

**Table 1 – Case size reference and dimensions**

Case size reference	Dimension						
	mm						
	<i>L</i>	<i>W</i>	<i>H</i>				

NOTE 1 When there is no case size reference, Table 1 may be omitted and the dimensions should be given in Table 2, which then becomes Table 1.

NOTE 2 The dimensions should be given as maximum dimensions or as nominal dimensions with a tolerance.

NOTE 3 *L*, *W*, *H* of the symbols of Table 1 is the example of the corner shape capacitors.



**1.3 Ratings and characteristics**

Rated capacitance range (see Table 2)

Tolerance on rated capacitance

Rated voltage (see Table 2)

Surge voltage (see Table 2)

Climatic category

Rated temperature

Rated ripple current (see Table 3)

Tangent of loss angle (see Table 3)

Leakage current (see Table 3)

Equivalent series resistance (see Table 3)

**Table 2 – Values of capacitance and of voltage related to case sizes**

<b>Rated voltage</b> V				
<b>Surge voltage</b> V				
<b>Rated capacitance</b> $\mu\text{F}$	<b>Case sizes</b>	<b>Case sizes</b>	<b>Case sizes</b>	<b>Case sizes</b>

**Table 3 – Values of rated ripple current, equivalent series resistance, tangent of loss angle and leakage current**

$U_R$ V	$C_R$ $\mu\text{F}$	<b>Rated ripple current</b> A	<b>Equivalent series resistance</b> $\text{m}\Omega$	<b>Tangent of loss angle</b> $\tan \delta$	<b>Leakage current</b> $\mu\text{A}$
		at 105 °C or 125 °C and 100 kHz (if applicable)	at 20 °C and 100 kHz	at 20 °C and 120 Hz	

**Table 4 – Values of resistance to soldering heat, damp heat, steady state and characteristics at high temperature**

$U_R$ V	$C_R$ $\mu\text{F}$	<b>Resistance to soldering heat</b>		<b>Damp heat, steady state</b>	<b>Characteristics at high temperature</b>
		$\Delta C/C$ %	$\Delta \text{ESR}/\text{ESR}$ %	$\Delta C/C$ %	$\Delta C/C$ %

## 1.4 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 60384-1:1999, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60384-25: *Fixed capacitors for use in electronic equipment – Part 25: Sectional specification: Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte*

## 1.5 Marking

The marking of the capacitor and the package shall be in accordance with the requirements of 1.6 of IEC 60384-25.

NOTE The details of the marking of the component and package should be given in full in the detail specification.

## 1.6 Ordering information

Orders for capacitors covered by this specification shall contain, in clear or in coded form, the following minimum information:

- a) rated capacitance;
- b) tolerance on rated capacitance;
- c) rated d.c. voltage;
- d) number and issue reference of the detail specification and style reference;
- e) packaging instructions.

## 1.7 Certified records of released lots

Required/not required.

## 1.8 Additional information (not for inspection purposes)

## 1.9 Additional or increased severities or requirements to those specified in the generic and/or sectional specification

NOTE Additions or increased requirements should be specified only when essential.

**Table 5 – Other characteristics**

This table is to be used for defining characteristics which are additional to, or more severe than, those given in the sectional specification.

## 2 Inspection requirements

### 2.1 Procedures

**2.1.1** For qualification approval, the procedures shall be in accordance with 3.4 of IEC 60384-25.

**2.1.2** For quality conformance inspection, the test schedule (Table 6) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by 3.5.1 of IEC 60384-25.

**Table 6 – Test schedule for quality conformance inspection**

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			<i>IL</i>	<i>n</i>	<i>c</i>	
<b>Group A inspection</b> (lot-by-lot)  <b>Subgroup A0</b> 4.20 High surge current (if applicable) 4.5.1 Leakage current 4.5.2 Capacitance 4.5.3 Tangent of loss angle ( $\tan \delta$ ) 4.5.4 Equivalent series resistance (ESR)	ND	Protective resistor: 1 000 $\Omega$  Frequency: 120 Hz Frequency: 120 Hz  Frequency: 100 kHz	100 % <sup>c</sup>			As in Table 3  Within specified tolerance As in Table 3  As in Table 3
<b>Subgroup A1</b> 4.4 Visual examination	ND		S-3	d	0	As in 4.4.2  Legible marking (if required) and as specified in the detail specification
<b>Subgroup A2</b> 4.4 Dimension (detail) <sup>e</sup>	ND		S-3	d	0	As specified in Table 1 of this specification
<b>Group B inspection</b> (lot-by-lot) 4.7 Solderability 4.7.1 Test  4.7.2 Final measurement  4.19 Solvent resistance of the marking (if applicable)	D	See detail specification for the method  Visual examination  Solvent: ... Solvent temperature: ... Method 1 Rubbing material: cotton wool Recovery time: ...	S-3	d	0	As in 4.7.2  Legible marking

**Table 6 – Test schedule for quality conformance inspection** (*continued*)

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			<i>p</i>	<i>n</i>	<i>c</i>	
<b>Group C inspection</b> (Periodic) <b>Subgroup C1</b> 4.6 Resistance to soldering heat 4.6.1 Initial measurement 4.6.2 Test  4.6.3 Final measurement  4.18 Component solvent resistance (if applicable)	D	Capacitance  Method: ... Deflection: ...s Reflow profile: ... Recovery: 24 h ± 2 h Visual examination Leakage current Capacitance Tangent of loss angle (tan δ) Equivalent series resistance (ESR)  Solvent: ... Solvent temperature: ... Method 2 Recovery: ...	3	12	0 g	For use as reference value    As in 4.6.3 As in Table 3 As in Table 4 As in Table 3 As in Table 4  See detail specification
<b>Sub group C2</b> 4.9 Substrate bending test 4.9.1 Initial measurement 4.9.3 Final inspection	D	Capacitance  Capacitance (with printed board in bent position)	3	12	0 g	For use as reference value  See detail specification
<b>Sub group C3</b> 4.3 Mounting <sup>h</sup> 4.3. Initial measurement 4.3.3 Final inspection	D	Substrate material: ...  Capacitance (the value obtained in 4.5.2 may be used)  Visual examination Leakage current Capacitance  Tangent of loss angle (tan δ) Equivalent series resistance (ESR)				No visible damage As in Table 3 $\Delta C/C \leq \pm 15\%$ at $U_R \leq 4$ $\Delta C/C \leq \pm 10\%$ at $U_R > 4$ As in Table 3 See detail specification

**Table 6 – Test schedule for quality conformance inspection** (*continued*)

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			<i>p</i>	<i>n</i>	<i>c</i>	
<b>Subgroup C3.1</b>	D		6	12	0	
4.8 Shear test		Visual examination			9	No visible damage
4.10 Rapid change of temperature						
4.10.1 Initial measurement		Capacitance (the value obtained in Group 3 may be used)				
4.10.2 Conditioning		$T_A$ = Lower category temperature $T_B$ = Upper category temperature Five cycles Duration $t_1$ = 30 min Recovery: 1 h to 2 h				
4.10.3 Final measurements		Leakage current Capacitance  Tangent of loss angle ( $\tan \delta$ )				As in Table 3 $\Delta C/C \leq \pm 10\%$ of the value measured in 4.10.1 As in Table 3
4.11 Climatic sequence						
4.11.1 Initial measurement		Capacitance (the value obtained in 4.10.3 may be used)				
4.11.2 Dry heat		Temperature: upper category temperature Duration: 16 h				
4.11.3 Damp heat, cyclic, test Db, first cycle						
4.11.4 Cold		Temperature: lower category temperature Duration: 2h				
4.11.5 Damp heat, cyclic, test Db, remaining cycles		Recovery: 1 h to 2 h				
4.11.6 Final measurements		Visual examination  Leakage current Capacitance  Tangent of loss angle				No visible damage Legible marking As in Table 3 $\Delta C/C \leq \pm 20\%$ of the value measured in 4.11.1 $\leq 1,5$ times the limit of Table 3

**Table 6 – Test schedule for quality conformance inspection** *(continued)*

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			<i>p</i>	<i>n</i>	<i>c</i>	
<b>Subgroup C3.2</b>	D		6	24	0	
4.12 Damp heat, steady state		Recovery: 1 h to 2 h			g	
4.12.1 Initial measurement		Capacitance (the value obtained in Group 3 may be used)				
4.12.3 Final measurements		Visual examination				No visible damage
		Leakage current				Legible marking
		Capacitance				5 times initial limit
		Tangent of loss angle				As in Table 4
						≤1,5 times the limit of Table 3
<b>Sub group C3.3</b>	D		6	12	0	
4.13 Characteristics at high and low temperature		The capacitors shall be measured at each temperature step			g	
		Step 1: 20 °C				
		Capacitance (if applicable)				For use as reference value
		Impedance				For use as reference value
		Tangent of loss angle (if applicable)				
		Step 2: lower category temperature				
		Capacitance (if applicable)				$\Delta C/C \leq \pm 20\%$ of the value measured in Step 1
		Impedance				Ratio with respect to value in Step 1: ≤1,5 times
		Tangent of loss angle (if applicable)				≤ 2 times the limit of Table 3
		Step 3: upper category temperature				
		Leakage current				At 105 °C (with $U_R$ ) :
						≤ 12,5 times the limit of Table 3
		Capacitance (if applicable)				$\Delta C/C \leq \pm 20\%$
		Tangent of loss angle (if applicable)				At $U_R \leq 4$ : ≤ 3 times the limit of Table 3
						At $U_R > 4$ : ≤ 2 times the limit of Table 3

**Table 6 – Test schedule for quality conformance inspection** (*continued*)

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			<i>p</i>	<i>n</i>	<i>c</i>	
4.17 Charge and discharge (if applicable)  4.17.1 Initial measurement  4.17.3 Final measurements		Temperature: ... °C Number of cycles: 10 <sup>6</sup> Duration of charge: 0.5 s Duration of discharge: 0.5 s Capacitance  Visual examination  Leakage current Capacitance  Tangent of loss angle  Equivalent series resistance				No visible damage Legible marking As in Table 3 $\Delta C/C \leq \pm 20\%$ of the value measured in 4.18.1 $\leq 1,5$ times the limit of Table 3 $\leq 2$ times the limit of Table 3
<b>Subgroup C3.4</b> 4.15 Endurance  4.15.1 Initial measurement  4.15.3 Final measurements	D	Duration: 1 000 h Test temperature: ... °C Voltage: ... V Recovery: 1 h to 2 h Capacitance  Visual examination  Leakage current  Capacitance  Tangent of loss angle  Equivalent series resistance	3	36	0 g	No visible damage Legible marking $\leq 2$ times the limit of Table 3 $\Delta C/C \leq \pm 20\%$ of the value measured in 4.15.1 $\leq 1,5$ times the limit of Table 3 $\leq 2$ times the limit of Table 3

**Table 6 - Test schedule for quality conformance inspection** (*continued*)

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			<i>p</i>	<i>n</i>	<i>c</i>	
<b>Subgroup C3.5</b>	D		6	12	0	
4.16 Storage at high temperature		Test temperature: upper category temperature Duration: 96 h ± 4 h Recovery: 16 h min			g	
4.16.1 Initial measurement		Capacitance (the value obtained in Group 3 may be used)				
4.16.3 Final measurements		Visual examination Leakage current Capacitance				No visible damage < 2 times the limit specified in 4.5.1 $\Delta C/C \leq \pm 10\%$ of the value measured in 4.16.1
4.14 Surge		Tangent of loss angle Number of cycles: 1 000 Test temperature: ...°C Voltage: 1,15 $U_R$ Protective resistor: 1 000 $\Omega$ Duration of charge: 30 s Duration of no-load: 5 min 30 s				As in Table 3
4.14.3 Final measurements		Visual examination Leakage current Capacitance Tangent of loss angle				No visible damage As in Table 3 $\Delta C/C \leq \pm 15\%$ of the value measured in 4.17.3 $\leq 1,5$ times the limit of Table 3
<sup>a</sup> Subclause numbers of tests and performance requirements refer to IEC 60384-25 and Clause 1 of this specification. <sup>b</sup> In this table <i>p</i> = periodicity (in months), <i>n</i> = sample size, <i>c</i> = acceptance criterion (permitted number of non-conforming items), D = destructive, ND = non-destructive, <i>IL</i> = inspection level <sup>c</sup> 100 % testing shall be followed by re-inspection by sampling in order to monitor outgoing quality level by non-conforming items per million (ppm). The sampling level shall be established by the manufacturer. For the calculation of ppm values, any parametric failure shall be counted as a non-conforming item. If one or more non-conforming items occur in a sample, this lot shall be rejected. <sup>d</sup> Inspection levels are selected from IEC 60410. <sup>e</sup> This test may be replaced by in-production testing if the manufacturer installs Statistical Process Control (SPC) on dimensional measurements or other mechanisms to avoid parts exceeding the limits. <sup>f</sup> This test may be carried out on capacitors mounted on a substrate. <sup>g</sup> If one non-conforming item is obtained, all the tests of the subgroup shall be repeated on a new sample and then no further non-conforming items are permitted. Release of product may continue during repeat testing. <sup>h</sup> The capacitors found non-conformances after mounting shall not be taken into account when calculating the non-conformances for the following tests. They shall be replaced by spare capacitors.						





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**Q8** I read/use the: (tick one)

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 English text only ☐  
 both English and French texts ☐

**Q9** Please share any comment on any aspect of the IEC that you would like us to know:

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