

# INTERNATIONAL STANDARD

**IEC**  
**60384-13-1**

QC 301801

Second edition  
2006-01

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

### **Part 13-1:**

#### **Blank detail specification –**

#### **Fixed polypropylene film dielectric metal foil d.c. capacitors –**

#### **Assessment level E**

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Reference number  
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### foil d.c. capacitors –

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**

**Part 13-1: Blank detail specification – Fixed polypropylene film dielectric metal foil d.c. capacitors – Assessment level E**

FOREWORD

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International Standard IEC 60384-13-1 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 1991 and constitutes a minor revisions related to tables, figures and references.

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

FDIS	Report on voting
40/1621/FDIS	40/1644/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.

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).

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 3000 V – Selection of methods of test and general requirements
- Part 6: Sectional specification: Fixed metallized polycarbonate film dielectric 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 electrolyte
- Part 19: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric chip d.c. capacitors
- Part 20: Sectional specification: Fixed metallized polyphenylene sulfide 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<sup>1</sup>

Part 25: Sectional specification – Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte<sup>1</sup>

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.

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<sup>1</sup> To be published.

## **FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**

### **Part 13-1: Blank detail specification – Fixed polypropylene film dielectric metal foil d.c. capacitors – Assessment level E**

#### **Blank detail specification**

A blank detail specification is a supplementary document to the sectional specification and contains requirements for style and 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 brackets on the first page 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).

When the capacitor is not designed for use in printed-board applications, this shall be clearly stated in the detail specification in this position.

- (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.

The assessment level(s) to be used in a detail specification shall be selected from the sectional specification, 3.5.4. This implies that one blank detail specification may be used in combination with several assessment levels, provided the grouping of the tests does not change.

- (9) Reference data on the most important properties, to allow comparison between the various capacitor types.

(1)	IEC 60384-13-1-XXX (2) QC 301801-XXX
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH:  (3)	IEC 60384-13-1 (4) QC 301801
	FIXED POLYPROPYLENE (5) FILM DIELECTRIC METAL FOIL DC CAPACITORS
Outline drawing: (see Table 1) (...angle projection)  (7)  (Other shapes are permitted within the dimensions given.)	(6)
	Assessment level(s): E (8)  Stability class:

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

(9)

**1 General data**

**1.1 Recommended method(s) of mounting**

See IEC 60384-13, 1.4.2.

**1.2 Dimensions**

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

Case size reference	Dimensions (in mm)					
	$\varnothing$	<i>L</i>	<i>H</i>	<i>d</i>	.....	

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

The dimensions shall be given as maximum dimensions or as nominal dimensions with a tolerance.

### 1.3 Ratings and characteristics

Capacitance range	(see Table 2)
Tolerance on rated capacitance	
Rated voltage	(see Table 2)
Category voltage (if applicable)	(see Table 2)
Climatic category	
Rated temperature	
Maximum a.c. voltage (if applicable)	
Tangent of loss angle	
Insulation resistance	

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

<b>Rated voltage</b>				
<b>Category voltage<sup>a</sup></b>				
<b>Rated capacitance</b> (in pF, nF and/or µF)	<b>Case size</b>	<b>Case size</b>	<b>Case size</b>	<b>Case size</b>
<sup>a</sup> If different from the rated voltage.				

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

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

IEC 60384-13, *Fixed capacitors for use in electronic equipment – Part 13: Sectional Specification: Fixed polypropylene film dielectric metal foil d.c. capacitors*

### 1.5 Marking

The marking of the capacitor and the package shall be in accordance with the requirements of IEC 60384-13, 1.6.

The details of the marking of the component and package shall 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:

- rated capacitance;
- tolerance on rated capacitance;
- rated d.c. voltage;
- number and issue reference of the detail specification and style reference.

**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 3 – 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.
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**2 Inspection requirements**

**2.1 Procedures**

**2.1.1** For qualification approval, the procedures shall be in accordance with the sectional specification, IEC 60384-13, 3.4.

**2.1.2** For quality conformance inspection, the test schedule (Table 4) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by IEC 60384-13, 3.5.1.

Table 4 – Test schedule for quality conformance inspection

Subclause number and test <sup>a</sup>	D or ND <sup>c</sup>	Conditions of test <sup>a</sup>	IL	E level	EZ level		Performance requirements <sup>a</sup>
				AQL	n	c	
<b>Group A inspection</b> (lot-by-lot)  <b>Subgroup A0</b> 4.2.2 Capacitance 4.2.3 Tangent of loss angle 4.2.1 Voltage proof (Test A) 4.2.4 Insulation resistance (Test A)	ND	Frequency : 1 kHz for all capacitance values  Method: ... Measuring point 1a  Measuring point 1a				100 % <sup>d</sup>	Within specified tolerance As in 4.2.3.2  No breakdown or flashover. Self-healing breakdowns allowed  As in 4.2.4.3
<b>Subgroup A1</b> 4.1 Visual examination  4.1 Dimensions (gauging)	ND		S-3	2,5%	<sup>b</sup>	0	As in 4.1 Legible marking and as specified in 1.5 of this specification  As specified in Table 1 of this specification
<b>Subgroup A2</b> 4.2.1 Voltage proof (Test A) 4.2.2 Capacitance 4.2.3 Tangent of loss angle 4.2.4 Insulation resistance (Test A)	ND	Method: ...  Method: ...	S-3	1,0%	<sup>b</sup>	0	No breakdown or flashover Within specified tolerance  As in 4.2.3.2  As in 4.2.4.2
<b>Group B inspection</b> (lot-by-lot)  <b>Subgroup B1</b> 4.5 Solderability  4.14 Solvent resistance of the marking (if applicable)	ND	Without ageing Method: ...  Solvent: ... Solvent temperature: ... Method 1 Rubbing material: cotton wool Recovery time: ...	S-3	2,5%	<sup>b</sup>	0	Good tinning as evidenced by free flowing of the solder with wetting of the terminations or solder shall flow within ... s, as applicable  See detail specification

Table 4 (continued)

Subclause number and test <sup>a</sup>	D or ND <sup>c</sup>	Conditions of test <sup>a</sup>	Sample size and criterion of acceptability <sup>c</sup>						Performance requirements <sup>a</sup>
			E			EZ			
			<i>p</i>	<i>n</i>	<i>c</i>	<i>p</i>	<i>n</i>	<i>c</i>	
<b>Group C inspection</b> (periodic)									
<b>Subgroup C1A</b> Part of sample of Subgroup C1	D		6	9	1	6	5	0	
4.1 Dimensions (detail)									See detail specification
4.3.1 Initial measurements		Capacitance Tangent of loss angle:							
4.3 Robustness of terminations		Visual examination							No visible damage
4.4 Resistance to soldering heat		Method: Recovery: 1 h to 2 h							
4.4.2 Final measurements		Visual examination  Capacitance							No visible damage Legible marking $\Delta C/C$ within limit for relevant stability class at upper category temperature as specified in 2.2.4 of the sectional specification and compared to the value measured in 4.3.1
4.13 Component solvent resistance (if applicable)		Solvent: ... Solvent temperature: ... Method 2 Recovery time:							See detail specification
<b>Subgroup C1B</b> Other part of sample of Subgroup C1	D		6	18	1	6	5	0	
4.6.1 Initial measurements		Capacitance Tangent of loss angle:							
4.6 Rapid change of temperature		$T_A$ = Lower category temperature $T_B$ = Upper category temperature  Five cycles Duration $t = 30$ min  Visual examination							
4.7 Vibration		Method of mounting: see 1.1 of this specification  Frequency range: ... Hz to ... Hz  Amplitude 0,75 mm or acceleration 100 m/s <sup>2</sup> (whichever is the less severe)  Total duration: 6 h							No visible damage

Table 4 (continued)

Subclause number and test <sup>a</sup>	D or ND <sup>c</sup>	Conditions of test <sup>a</sup>	Sample size and criterion of acceptability <sup>c</sup>						Performance requirements <sup>a</sup>
			E			EZ			
			<i>p</i>	<i>n</i>	<i>c</i>	<i>p</i>	<i>n</i>	<i>c</i>	
4.7.2 Final inspection		Visual examination Capacitance							No visible damage  $\Delta C/C$ within limit for relevant stability class at upper category temperature as specified in 2.2.4 of the sectional specification and compared to the value measured in 4.6.1
4.8 Bump (or shock, see 4.9)		Method of mounting: see 1.1 of this specification  Number of bumps: ... Acceleration: .. m/s <sup>2</sup> Duration of pulse: ... ms							
4.9 Shock (or bump, see 4.8)		Method of mounting: see 1.1 of this specification  Acceleration: .. m/s <sup>2</sup> Duration of pulse: ... ms							
4.8.3 Final or measurements 4.9.3		Visual examination  Capacitance  Tangent of loss angle							No visible damage  $\Delta C/C$ within limit for relevant stability class at upper category temperature as specified in 2.2.4 of the sectional specification and compared to the value measured in 4.7.2 As in 4.2.3.2
<b>Subgroup C1</b> Combined sample of specimens of Subgroups C1A and C1B	D		6	27	2	6	10	0	
4.10 Climatic sequence									
4.10.2 Dry heat		Temperature: upper category temperature Duration: 16 h							
4.10.3 Damp heat, cyclic, Test Db, first cycle									
4.10.4 Cold		Temperature: lower category temperature Duration: 2 h							
4.10.5 Low air pressure (if required by the detail specification)		Air pressure: 8 kPa Duration: 1 h							
4.10.5.3 Intermediate measurement		Visual examination							No permanent breakdown, flashover or harmful deformation of the case
4.10.6 Damp heat, cyclic, Test Db, remaining cycles		Recovery: 1 h to 2 h							

**Table 4 (continued)**

Subclause number and test <sup>a</sup>	D or ND <sup>c</sup>	Conditions of test <sup>a</sup>	Sample size and criterion of acceptability <sup>c</sup>						Performance requirements <sup>a</sup>
			E			EZ			
			<i>p</i>	<i>n</i>	<i>c</i>	<i>p</i>	<i>n</i>	<i>c</i>	
4.10.6.2 Final measurement		Visual examination  Capacitance  Tangent of loss angle  Insulation resistance							No visible damage Legible marking  $\Delta C/C$ within limit for relevant stability class at 85 °C as specified in 2.2.4 of the sectional specification and compared to the value measured in 4.4.2, 4.8.3 or 4.9.3, as applicable  $\tan \delta \leq 1,4$ times value measured in 4.3.1 or 4.6.1, as applicable  $\geq 50$ % of values in 4.2.4.2
<b>Subgroup C2</b>  4.11 Damp heat, steady state  4.11.1 Initial measurements  4.11.3 Final measurement	D	Capacitance Tangent of loss angle Recovery: 1 h to 2 h Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	6	15	1	6	10	0	No visible damage Legible marking  $\Delta C/C$ within limit for relevant stability class at 85 °C as specified in 2.2.4 of the sectional specification and compared to the value measured in 4.11.1  $\tan \delta \leq 1,4$ times value measured in 4.11.1  $\geq 50$ % of values in 4.2.4.2
<b>Subgroup C3</b>  4.12 Endurance  4.12.1 Initial measurement  4.12.5 Final measurement	D	Duration: ... h  Capacitance Tangent of loss angle: Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	3	21	1	6	10	0	No visible damage Legible marking  $\Delta C/C$ within limit for relevant stability class at upper category temperature as specified in 2.2.4 of sectional specification and compared to value measured in 4.12.1  $\tan \delta$ as in 4.2.3.2 or $\leq 1,4$ times value measured in 4.12.1, whichever is the greater  $\geq 50$ % of values in 4.2.4.2

Table 4 (continued)

Subclause number and test <sup>a</sup>	D or ND <sup>c</sup>	Conditions of test <sup>a</sup>	Sample size and criterion of acceptability <sup>c</sup>						Performance requirements <sup>a</sup>
			E			EZ			
			<i>p</i>	<i>n</i>	<i>c</i>	<i>p</i>	<i>n</i>	<i>c</i>	
<b>Subgroup C4</b>	D	Capacitance	12	9	1	6	10	0	As in 4.2.5  $L \leq \dots$ mH  As in 4.2.7
4.2.5	Characteristics depending on temperature								
4.2.6	Inductance (if required)								
4.2.7	Outer foil termination (if required)								

<sup>a</sup> Subclause numbers of tests and performance requirements refer to the sectional specification, IEC 60384-13, and Clause 1 of this specification.

<sup>b</sup> Number to be tested: sample size as directly allotted to the code letter for *IL* in Table 2a of IEC 60410.

<sup>c</sup> In this table:  
*p* = periodicity (in months);  
*n* = sample size;  
*c* = acceptance criterion (permitted number of defectives);  
D = destructive;  
ND = non-destructive;  
*IL* = inspection level;  
*AQL* = acceptable quality level } See IEC 60410

<sup>d</sup> 100 % testing shall be followed by re-inspection by sampling in order to monitor outgoing quality level by nonconforming items per million ( $10^{-6}$ ). The sampling level shall be established by the manufacturer. For the calculation of  $10^{-6}$  values, any parametric failure shall be counted as a nonconforming item. If one or more nonconforming items occur in a sample, this lot shall be rejected.

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