

# INTERNATIONAL STANDARD

**IEC**  
**60384-17-1**

QC 301301

Second edition  
2005-11

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

**Part 17-1:**

**Blank detail specification:**

**Fixed metallized polypropylene film**

**dielectric a.c. and pulse capacitors –**

**Assessment levels E and EZ**

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## Fixed capacitors for use in electronic equipment –

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### Blank detail specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors – Assessment levels E and EZ

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 17-1: Blank detail specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors – Assessment levels E and EZ**

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International Standard IEC 60384-17-1 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 1987 and constitutes minor revisions related to tables, figures and references.

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

FDIS	Report on voting
40/1598/FDIS	40/1631/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 (new) 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 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 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 (under consideration)
- Part 25: Sectional specification – Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte (under consideration)

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 QC 301301 number that appears on the front cover of this publication is the specification number in the IECQ Quality Assessment System for Electronic Components.

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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## FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

### Part 17-1: Blank detail specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors – Assessment levels E and EZ

## INTRODUCTION

### 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 be so 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).  
NOTE When the capacitor is not designed for use in printed board applications, this must 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 appendix to the detail specification.
- [8] Application or group of applications covered and/or assessment level.  
NOTE The assessment level(s) to be used in a detail specification must 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 60384-17-1-XXX QC XXXXXXXXXXXX	[2]
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH:	IEC 60384-17-1 QC XXXXXX	[4]
[3]	FIXED METALLIZED POLYPROPYLENE FILM DIELECTRIC AC AND PULSE CAPACITORS	[5]
Outline drawing (see Table 1) (first angle projection)		[6]
[7]	Assessment levels E and EZ Performance grade: Stability grade:	[8]
(Other shapes are permitted within the dimensions given)		
NOTE For [1] to [9]: see previous page.		

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 (to be inserted)

See IEC 60384-17, 1.4.2.

### 1.2 Dimensions

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

Case size reference	Dimensions						
	∅	L	H	d	.....		

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)

– rated d.c. voltage (if applicable)

– rated a.c. voltage (and frequency if different from 50/60 Hz)

Category voltage (if applicable) (see Table 2)

Climatic category

AC rated temperature

Tangent of loss angle (frequency ...) (see Table 2)

Insulation resistance (see Table 2)

Rated peak current or rated voltage pulse slope  $\frac{dU}{(dt)_R}$  (if applicable)

Sinusoidal rated a.c. current (at reference frequency ...) and derating curve versus temperature (if applicable)

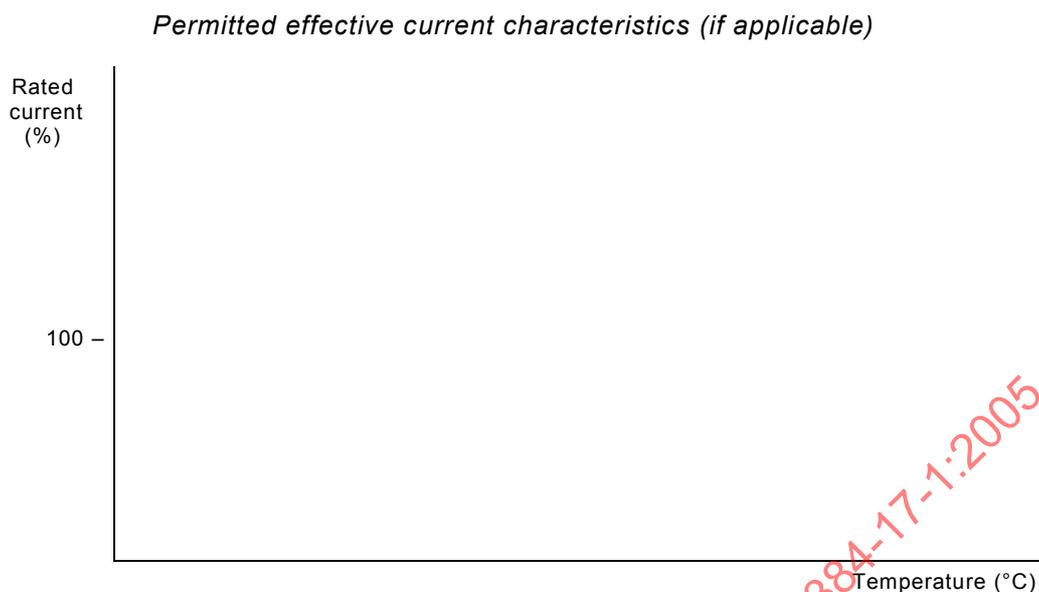
Reference frequency (if applicable)

**Table 2 – Values of capacitance, a.c. voltage and peak current (or voltage pulse slope), related to case sizes**

Rated a.c. voltage ( $U_{R-}$ )				
Category voltage <sup>1)</sup> ( $U_{C-}$ )				
	Rated capacitance (in nF or µF)	Peak current or dU/dt	Rated capacitance (in nF or µF)	Peak current or dU/dt
Case size reference				
1) If different from the rated voltage.				

**Table 2a (if applicable) – Rated a.c. current related to rated a.c. voltage and rated capacitance and case sizes**

Rated a.c. voltage ( $U_{R-}$ )				
Rated a.c. current	Rated capacitance (in nF and/or µF)	Case size	Rated capacitance (in nF and/or µF)	Case size
NOTE Other presentations are possible.				



**Table 3 – Particular characteristics**

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

IEC 60384-17, *Fixed capacitors for use in electronic equipment – Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors*

#### 1.5 Marking

The marking of the capacitor and the packing shall be in accordance with the requirements of IEC 60384-17, 1.6.

NOTE The details of the marking of the component and packing must 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 a.c. voltage, and frequency if different from 50/60 Hz (if applicable);
- d) rated voltage, pulse slope or peak current (if applicable);
- e) rated a.c. current and corresponding frequency (if applicable);
- f) number and issue reference of the detail specification and style reference;
- g) performance and stability grade (if required).

### 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 60384-17, 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 3.5.1 of the sectional specification.

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**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 lev.	EZ lev.		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>g</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> 4.2.2 Capacitance 4.2.3 Tangent of loss angle 4.2.1 Voltage proof (Test A) 4.2.4 Insulation resistance (Test A)	ND	Method: ...  Method: ...	S-3	1,0%	<sup>b</sup>	0	Within specified tolerance As in 4.2.3.2 No breakdown or flashover As in 4.2.4.2
<b>Group B inspection</b> (lot-by-lot)  <b>Subgroup B1</b> 4.5 Solderability  4.15 Solvent resistance of the marking (if applicable)	ND	Without ageing Method: ...  Solvent: ... Solvent temperature: ... Method 1 Rubbing material: ... 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  Legible marking

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				
			p	n	c	p	n	c		
<b>Group C inspection</b> (periodic)										
<b>Subgroup C1A</b> Part of sample of Subgroup C1										
4.1 Dimensions (detail)	D	Capacitance Tangent of loss angle: for $C_R > 1 \mu\text{F}$ : at 1 kHz $C_R \leq 1 \mu\text{F}$ : at 10 kHz  Visual examination  Method: ...  Visual examination  Capacitance  Tangent of loss angle  Solvent: ... Solvent temperature: ... Method 2 Recovery time:	6	9	1	6	5	0	See detail specification	
4.3.1 Initial measurements										
4.3 Robustness of terminations										No visible damage
4.4 Resistance to soldering heat										
4.4.2 Final measurements										No visible damage Legible marking $\Delta C/C$ for Grade 1.1: $\leq 1\%$ Grade 1.2: $\leq 2\%$ Grade 2: $\leq 3\%$ of value measured in 4.3.1 Increase of $\tan \delta$ for $C \leq 1 \mu\text{F}$ : for Grade 1.1: $\leq 0,001$ Grade 1.2: $\leq 0,002$ Grade 2: $\leq 0,004$ for $C > 1 \mu\text{F}$ : see detail specification, compared to values measured in 4.3.1
4.14 Component solvent resistance (if applicable)								See detail specification		
<b>Subgroup C1B</b> Other part of sample of Subgroup C1										
4.6.1 Initial measurements	D	Capacitance Tangent of loss angle: for $C_R > 1 \mu\text{F}$ : at 1 kHz $C_R \leq 1 \mu\text{F}$ : at 10 kHz  $T_A$ = Lower category temperature $T_B$ = Upper category temperature  Five cycles Duration $t = 30$ min  Visual examination	6	18	1	6	5	0		
4.6 Rapid change of temperature										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			
			p	n	c	p	n	c	
4.7 Vibration		Method of mounting: see 1.1 of this specification							
4.7.2 Final inspection		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  Visual examination							No visible damage
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 or 4.9.3 Final measurements		Visual examination  Capacitance   Tangent of loss angle   Insulation resistance							No visible damage  $\Delta C/C$ for Grade 1.1: $\leq 1\%$ Grade 1.2: $\leq 2\%$ Grade 2: $\leq 3\%$ of value measured in 4.6.1  Increase of $\tan \delta$ for $C \leq 1 \mu F$ : for Grade 1.1: $\leq 0,001$ Grade 1.2: $\leq 0,002$ Grade 2: $\leq 0,004$ for $C > 1 \mu F$ : see detail specification, compared to values measured in 4.6.1  $\geq 50\%$ of the values in 4.2.4.2
<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							
4.10.5.3 Final measurement		Visual examination							No permanent breakdown, flashover or harmful deformation of the case

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			
			p	n	c	p	n	c	
4.10.6 Damp heat, cyclic, Test Db, remaining cycles 4.10.6.2 Final measurement		Visual examination  Capacitance  Tangent of loss angle  Insulation resistance							No visible damage Legible marking  $\Delta C/C$ for Grade 1.1: $\leq 1\%$ Grade 1.2: $\leq 3\%$ Grade 2: $\leq 5\%$ of value measured in 4.4.2, 4.8.3 or 4.9.3 as applicable  Increase of $\tan \delta$ : for $C \leq 1 \mu\text{F}$ : for Grade 1.1: $\leq 0,0015$ Grade 1.2: $\leq 0,003$ Grade 2: $\leq 0,005$ for $C > 1 \mu\text{F}$ : see detail specification, compared to values 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 at 1 kHz  Visual examination Capacitance  Tangent of loss angle  Insulation resistance	6	15	1	6	10	0	No visible damage Legible marking  $\Delta C/C$ for Grade 1.1: $\leq 1\%$ Grade 1.2: $\leq 3\%$ Grade 2: $\leq 5\%$ of value measured in 4.11.1 Increase of $\tan \delta$ : for $C \leq 1 \mu\text{F}$ : for Grade 1.1: $\leq 0,001$ Grade 1.2: $\leq 0,002$ for $C > 1 \mu\text{F}$ : see detail specification, compared to values measured in 4.11.1  $\geq 50\%$ of values in 4.2.4.2
<b>Subgroup C3A</b> 4.12.1 Endurance test at 50/60 Hz alternating voltage (if applicable) 4.12.1.1 Initial measurement	D	Duration: Grade 1: 2 000 h Grade 2: 1 000 h  Capacitance Tangent of loss angle: for $C_R > 1 \mu\text{F}$ : at 1 kHz $C_R \leq 1 \mu\text{F}$ : at 10 kHz	3 <sup>4)</sup>	20	1	6	5	0	

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			
			p	n	c	p	n	c	
4.12.1.3 Final measurement		Visual examination  Capacitance  Tangent of loss angle  Insulation resistance							No visible damage Legible marking  $\Delta C/C$ for Grade 1: $\leq 5\%$ Grade 2: $\leq 10\%$ of value measured in 4.12.1.1  Increase of $\tan \delta$ : for $C \leq 1 \mu\text{F}$ : for Grade 1.1: $\leq 0,0015$ Grade 1.2: $\leq 0,003$ for $C > 1 \mu\text{F}$ : see detail specification, compared to values measured in 4.12.1.1  $\geq 50\%$ of values in 4.2.4.2
<b>Subgroup C3B</b>  4.12.2 Endurance test with sinusoidal current or voltage (if applicable)  4.12.2.1 Initial measurement  4.12.2.3 Final measurement	D	Duration: Grade 1: 2 000 h Grade 2: 1 000 h Frequency: ... Hz  Capacitance Tangent of loss angle: for $C_R > 1 \mu\text{F}$ : at 1 kHz $C_R \leq 1 \mu\text{F}$ : at 10 kHz  Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	3 <sup>d</sup>	5	1 <sup>e</sup>	6	5	0	No visible damage Legible marking  $\Delta C/C$ for Grade 1: $\leq 5\%$ Grade 2: $\leq 10\%$ of value measured in 4.12.2.1  Increase of $\tan \delta$ : for $C \leq 1 \mu\text{F}$ : for Grade 1.1: $\leq 0,0015$ Grade 1.2: $\leq 0,003$ for $C > 1 \mu\text{F}$ : see detail specification, compared to values measured in 4.12.2.1  $\geq 50\%$ of values in 4.2.4.2
<b>Subgroup C3C<sup>6)</sup></b> 4.12.3 Pulse endurance test (if applicable)  4.12.3.1 Initial measurement	D	Duration: 1000 h Pulse repetition rate: ... Hz Discharge time constant: as in 4.12.3.1 Applied peak voltage: equal to the rated peak voltage (Table 2 of this specification) Capacitance Tangent of loss angle: for $C_R > 1 \mu\text{F}$ : at 1 kHz $C_R \leq 1 \mu\text{F}$ : at 10 kHz	3 <sup>d</sup>	5	1 <sup>e</sup>	6	5	0	