

Fixed capacitors for use in electronic equipment —

Part 23-1: Blank detail specification —
Fixed surface mount metallized
polyethylene naphthalate film
dielectric DC capacitors — Assessment
level EZ

The European Standard EN 60384-23-1:2005 has the status of a
British Standard

ICS 31.060.10

National foreword

This British Standard is the official English language version of EN 60384-23-1:2005. It is identical with IEC 60384-23-1:2005.

The UK participation in its preparation was entrusted to Technical Committee EPL/40X, Capacitors and resistors for electronic equipment, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 13 and a back cover.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2006

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ISBN 0 580 48726 1

Amendments issued since publication

Amd. No.	Date	Comments

**Fixed capacitors for use in electronic equipment
Part 23-1: Blank detail specification –
Fixed surface mount metallized polyethylene naphthalate
film dielectric DC capacitors –
Assessment level EZ
(IEC 60384-23-1:2005)**

Condensateurs fixes utilisés
dans les équipements électroniques
Partie 23-1: Spécification particulière-
cadre –
Condensateurs fixes pour montage
en surface pour courant continu
à diélectrique en film de polyéthylène
naphtalate métallisé –
Niveau d'assurance EZ
(CEI 60384-23-1:2005)

Festkondensatoren zur Verwendung
in Geräten der Elektronik
Teil 23-1: Vordruck für Bauartspezifikation –
Oberflächenmontierbare metallisierte
Polyethylen-Naphthalat-Folien-
kondensatoren –
Qualitätsbewertungsstufe EZ
(IEC 60384-23-1:2005)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 40/1504/FDIS, future edition 1 of IEC 60384-23-1, prepared by IEC TC 40, Capacitors and resistors for electronic equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60384-23-1 on 2005-02-01.

The following dates were fixed:

- | | | |
|------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2005-12-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2008-02-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60384-23-1:2005 was approved by CENELEC as a European Standard without any modification.

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 23-1: Blank detail specification – Fixed surface mount metallized polyethylene naphthalate film dielectric DC capacitors – 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 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 Organisation 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 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 are selected from 3.5.4 of the sectional specification. 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 60384-23-1-XXX QC 30YYYYXXXXXX [2]
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH: [3]	IEC 60384-23-1 [4] QC 30YYYY
Outline drawing: [see table 1] [... angle projection] [7] [Other shapes are permitted within the dimensions given] For Notes [1] to [9] see preceding page.	FIXED METALLIZED POLYETHYLENE NAPHTHALATE FILM DIELECTRIC CHIP DC [5] CAPACITORS
	[6]
	Assessment level(s): EZ [8]

[9]

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

1 General data

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

See 1.4.2 of IEC 60384-23.

1.2 Dimensions

Table 1 – Dimensions

Case size reference	Dimensions mm						
	L ₁	W ₁	H ₁	L ₂	L ₃	L ₄	...

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

Max. AC voltage (if applicable)

Max pulse load (if applicable)

Tangent of loss angle

Insulation resistance

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

Rated voltage				
Category voltage ¹⁾				
	Case size	Case size	Case size	Case size
Rated capacitance µF				

¹⁾ If different from the rated voltage.

1.4 Normative references

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

IEC 60384-23, *Fixed capacitors for use in electronic equipment – Part 23: Sectional specification*

1.5 Marking

The marking of the capacitor and the package shall be in accordance with the requirements of 1.6 of IEC 60384-23.

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 DC voltage;
- number and issue reference of the detail specification and style reference;
- packaging instructions.

1.7 Certified records of released lots

Required/non required.

1.8 Additional information (not for inspection purposes)

1.9 Additional or increased severities or requirements to those specified in the generic 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.

2 Inspection requirements

2.1 Procedures

2.1.1 For qualification approval, the procedures shall be in accordance with 3.4 of the sectional specification, IEC 60384-23.

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.

Table 4 – Test schedule for quality conformance inspection

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	IL (see NOTE 3)	n (see NOTE 3)	c (see NOTE 3)	Performance requirements (see NOTE 1)
GROUP A INSPECTION (lot-by-lot)						
Subgroup A0	ND					
4.3.2 Capacitance						Within specified tolerance
4.3.3 Tangent of loss angle		Frequency: 1 kHz for all capacitance values				As in 4.3.3.2
4.3.1 Voltage proof (Test A)		Method: ... Measuring point 1a				No breakdown or flashover. Self-healing breakdowns allowed.
4.3.4 Insulation resistance (Test A)		Measuring point 1a				As in 4.3.4.3
Subgroup A1	ND		S-4	NOTE 2	0	
4.2.1 Visual examination						As in 4.2.2 Legible marking (if applicable) and as specified in 1.5 of this specification
Subgroup A2	ND		S-3	NOTE 2	0	
4.2 Dimensions (see NOTE 5)						As specified in Table 1 of this specification

Table 4 (continued)

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	IL	n	c	Performance requirements (see NOTE 1)
GROUP B INSPECTION (lot-by-lot)						
Subgroup B1	D		S-3	NOTE 2	0	
4.7 Solderability		No ageing Method: ...				
4.7.2 Final measurements		Visual examination				As in 4.7.2
Subgroup B2	D		S-3	NOTE 2	0	
4.14 Solvent resistance of the marking (if applicable) (see NOTE 6)		Solvent: ... Solvent temperature: ... Method 1 Rubbing material: cotton wool Recovery: ...				Legible marking

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size and acceptance criterion (see NOTE 3)			Performance requirements (see NOTE 1)
			p	n	c	
GROUP C INSPECTION (periodic)						
Subgroup C1	D		3	12	0 NOTE 7	
4.6 Resistance to soldering heat		Method: ...				
4.6.1 Initial measurements		Capacitance				
4.6.2 Test conditions		Duration: ... If Method 1 is applied immersion and withdrawal speed shall be 25 mm/s ± 2,5 mm/s				
4.6.3 Final measurements		Recovery: 24 h ± 2 h Visual examination Capacitance				As in 4.6.3 △ C/C ≤ 3 % for Grade 1 and Grade 2 ≤ 5 % for Grade 3 of value measured in 4.6.1
4.13 Component solvent resistance (if applicable)		Solvent: ... Solvent temperature: ... Method 2 Recovery: ...				See detail specification

Table 4 (continued)

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size and acceptance criterion (see NOTE 3)			Performance requirements (see NOTE 1)
			p	n	c	
Subgroup C2	D		3	12	0 NOTE 7	
4.5 Substrate bending test						
4.5.1 Initial measurements		Capacitance				
4.5.2 Final inspection		Capacitance (with board in bent position)				$\Delta C/C \leq 2\%$ for Grade 1 and Grade 2 $\leq 5\%$ for Grade 3 of value measured in 4.5.1
		Visual examination				
Subgroup C3	D					No visible damage
4.1 Mounting (see NOTE 8)		Substrate material: ...*				
4.2.1 Visual examination						As in detail specification
4.3.2 Capacitance						$\Delta C/C \leq 2\%$ of the value measured before mounting
4.3.3 Tangent of loss angle		Frequency: 1 kHz (for all capacitance values) 10 kHz for capacitors with $C_R \leq 1 \mu\text{F}$ (in addition, see 4.3.3.3)				As in 4.3.3.2 (Reference values for final measurements in Subgroup C3.1, C3.3 and C3.4)
4.3.4 Insulation resistance						As in 4.3.4.3

* When different substrate materials are used for the individual subgroups, the detail specification shall indicate which substrate material is used in each subgroup.

Subgroup C3.1		D		6	27	0 NOTE 7	
4.4	Shear						
4.4.1	Intermediate inspection		Visual examination				No visible damage
4.8	Rapid change of temperature						
4.8.1	Initial measurements		Not required, see Subgroup C3				
4.8.2	Test conditions		T = Lower category ^A temperature T = Upper category ^B temperature Five cycles Duration t = 30 min	1			
4.8.3	Intermediate inspection		Visual examination				No visible damage

Table 4 (continued)

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size and acceptance criterion (see NOTE 3)			Performance requirements (see NOTE 1)
			p	n	c	
4.9 Climatic sequence						
4.9.1 Initial measurements		Not required, see Subgroup C3				
4.9.2 Dry heat						
4.9.3 Damp heat, cyclic, test Db, first cycle		Temperature: upper category temperature Duration: 16 h				
4.9.4 Cold		Temperature: lower category temperature Duration: 2 h				
4.9.5 Damp heat, cyclic, test Db, remaining cycles		Within 15 min after removal from test chamber U_R to be applied for 1 min				
4.9.6 Final measurements		Visual examination				No visible damage Legible marking
		Capacitance				$\Delta C/C \leq 3\%$ for Grade 1 and Grade 2 $\leq 5\%$ for Grade 3 of the value measured in Subgroup C3
		Tangent of loss angle: at 10 kHz for $C_R \leq 1 \mu F$				Increase of $\tan \delta$: $\leq 0,0025$ for Grade 1 $\leq 0,004$ for Grade 2 $\leq 0,007$ for Grade 3 compared to values measured in Subgroup C3
		at 1 kHz for $C_R > 1 \mu F$				$\leq 0,003$ for Grade 1 $\leq 0,005$ for Grade 2 $\leq 0,007$ for Grade 3 compared to values measured in Subgroup C3
		Insulation resistance				$\geq 50\%$ of values in 4.3.4.3 for Grade 1 and Grade 2 $\geq 25\%$ of values in 4.3.4.3 for Grade 3

Table 4 (continued)

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size and acceptance criterion (see NOTE 3)			Performance requirements (see NOTE 1)
			p	n	c	
Subgroup C3.2						
4.10 Damp heat, steady state						
4.10.1 Initial measurement		Not required, see Subgroup C3				
4.10.2 Final measurement		Visual examination Capacitance Tangent of loss angle at 1 kHz Insulation resistance				No visible damage $\Delta C/C \leq 7\%$ for Grade 1 and Grade 2 $\leq 10\%$ for Grade 3 of the value measured in Subgroup C3 Increase of $\tan \delta$: $\leq 0,005$ compared to values measured in Subgroup C3 $\geq 50\%$ of values in 4.3.4.3 for Grade 1 and Grade 2 $\geq 25\%$ of values in 4.3.4.3 for Grade 3
Subgroup C3.3	D		3	15	0 NOTE 7	
4.11 Endurance						
4.11.1 Initial measurements		Not required, see Subgroup C3				
4.11.2 Test conditions		See 4.11.2, 4.11.3 and 4.11.4				
4.11.5 Final measurements		Visual examination Capacitance Tangent of loss angle: at 10 kHz for $C_R \leq 1\mu F$ at 1 kHz for $C_R > 1\mu F$ Insulation resistance				No visible damage Legible marking $\Delta C/C \leq 5\%$ for Grade 1 $\leq 8\%$ for Grade 2 and Grade 3 of values measured in Subgroup C3 Increase of $\tan \delta$: $\leq 0,003$ for Grade 1 $\leq 0,005$ for Grade 2 $\leq 0,007$ for Grade 3 compared to values measured in Subgroup C3 $\leq 0,002$ for Grade 1 $\leq 0,003$ for Grade 2 $\leq 0,005$ for Grade 3 compared to values measured in Subgroup C3 $\geq 50\%$ of values in 4.3.4.3 for Grade 1 and Grade 2 $\geq 25\%$ of values in 4.3.4.3 for Grade 3

Table 4 (continued)

Subclause number and test (see NOTE 1)	D or ND	Conditions of test (see NOTE 1)	Sample size and acceptance criterion (see NOTE 3)			Performance requirements (see NOTE 1)
			p	n	c	
Subgroup C3.4	D		6	9	0 NOTE 7	
4.12 Charge and discharge						
4.12.1 Initial measurements		Not required, see Subgroup C3				
4.12.2 Test conditions		10 000 cycles				
4.12.3 Final measurements		Capacitance				$\Delta C/C \leq 5\%$ for Grade 1 $\leq 8\%$ for Grade 2 $\leq 10\%$ for Grade 3 of the value measured in Subgroup C3 Increase of $\tan \delta$: $\leq 0,003$ for Grade 1 $\leq 0,005$ for Grade 2 $\leq 0,007$ for Grade 3 compared to values measured in Subgroup C3
		Tangent of loss angle: at 10 kHz for $C_R \leq 1 \mu F$				$\leq 0,002$ for Grade 1 $\leq 0,003$ for Grade 2 $\leq 0,005$ for Grade 3 compared to values measured in Subgroup C3
		at 1 kHz for $C_R > 1 \mu F$				$\geq 50\%$ of values in 4.3.4.3 for Grade 1 and Grade 2 $\geq 25\%$ of values in 4.3.4.3 for Grade 3
		Insulation resistance				

NOTE 1 Subclause numbers of tests and performance requirements refer to the sectional specification IEC 60384-21 and section 1 of this specification.

NOTE 2 Number to be tested: Sample size as directly allotted to the code letter for IL in Table IIA of IEC 60410 (Single sampling plan for normal inspection).

NOTE 3 In this table: IL = inspection level;
p = periodicity in months;
n = sample size;
c = acceptance criterion (permitted number of non-conforming items);
D = destructive;
ND = non-destructive.

NOTE 4 100 % 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. In case one or more non-conforming items occur in a sample, this lot shall be rejected.

NOTE 5 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.

NOTE 6 This may be carried out on chip capacitors mounted on a substrate.

NOTE 7 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.

NOTE 8 Any specimen found defective after mounting shall not be taken into account when calculating the permissible non-conforming items for the following tests. They shall be replaced by spare parts.

Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

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.

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60384-1 (mod)	1999	Fixed capacitors for use in electronic equipment Part 1: Generic specification	EN 60384-1 + Corr. October	2001 2001
IEC 60384-23	- 1)	Part 23: Sectional specification: Fixed surface mount metallized polyethylene naphthalate film dielectric d.c. capacitors	EN 60384-23	2005 2)

1) Undated reference.

2) Valid edition at date of issue.

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