BRITISH STANDARD

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60384-18-2:
2007

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

ICS 31.060.50

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 60384-18-2:2007. It is identical to IEC 60384-18-2:2007.

The UK participation in its preparation was entrusted to Technical Committee EPL/40X, Capacitors and resistors for electronic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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(IEC 60384-18-2:2007)

Condensateurs fixes utilisés dans les équipements électroniques - Partie 18-2: Spécification particulière cadre - Condensateurs fixes électrolytiques en aluminium pour montage en surface à électrolyte non solide - Niveau d'assurance de la qualité EZ (CEI 60384-18-2:2007)

Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 18-2: Vordruck für Bauartspezifikation - Oberflächenmontierbare Aluminium-Elektrolyt-Kondensatoren mit flüssigem Elektrolyten - Bewertungsstufe EZ (IEC 60384-18-2:2007)

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Ref. No. EN 60384-18-2:2007 E

Foreword

The text of document 40/1766/CDV, future edition 2 of IEC 60384-18-2, prepared by IEC TC 40, Capacitors and resistors for electronic equipment, was submitted to the IEC-CENELEC parallel Unique Acceptance Procedure and was approved by CENELEC as EN 60384-18-2 on 2007-04-01.

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)	2008-01-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-04-01

Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 60384-18-2:2007 was approved by CENELEC as a European Standard without any modification.

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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

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 correspond to the following information, which shall be inserted in the position indicated.

Identification of the detail specification

(1) The “International Electrotechnical Commission” (IEC) 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 is 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.

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 60384-18-2-XXX (2) QC 302302-XXX
ELECTRONIC COMPONENTS OF ASSESSED (3) QUALITY IN ACCORDANCE WITH:	IEC 60384-18-2 (4) QC 302302
Outline drawing: (see Table 1) (…angle projection) (7)	FIXED ALUMINIUM ELECTROLYTIC SURFACE MOUNT CAPACITORS WITH NON-SOLID ELECTROLYTE (5)
	(6)
(Other shapes are permitted within the dimensions given.)	Assessment level(s): EZ (8)

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 1.4.2 and 4.3 of IEC 60384-18.)

1.2 Dimensions

Table 1 – Case size reference and dimensions

Case size reference	Dimension(s) mm						
	Ø	*L*	*H*	*d*	.....		

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.

1.3 Ratings and characteristics

Rated 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	
Rated ripple current	(see Table 3)
Tangent of loss angle	(see Table 3)
Leakage current	
Impedance (if applicable)	(see Table 3)
Reverse voltage (if required)	
Insulation resistance (if applicable)	

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

Rated voltage				
Category voltage[a]				
Rated capacitance	Case size	Case size	Case size	Case size
µF				

[a] If different from the rated voltage.

Table 3 – Tangent of loss angle, impedance and rated ripple current

U_R	*C*	Tangent of loss angle at... °C,... Hz	Impedance at... °C ... Hz (if applicable)	Rated ripple current at... °C,... Hz
V	µF		Ω	A

NOTE Instead of the tangent of loss angle (tan δ), the equivalent series resistance ESR may be specified in accordance with 4.5.3.2b) of IEC 60384-18.

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 60384-18:2007, *Fixed capacitors for use in electronic equipment – Part 18: Sectional specification – Fixed aluminium electrolytic surface mount capacitors with solid (MnO_2) and non-solid electrolyte*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

1.5 Marking

The marking of the capacitor, if applied, and the package shall be in accordance with the requirements of 1.6 of IEC 60384-18.

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 4 – 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 60384-18.

2.1.2 For quality conformance inspection, the test schedule (Table 5) includes sampling, periodicity, severities and requirements. The formation of inspection lots is covered by 3.5.1 of the sectional specification.

Table 5 – Test schedule for qualification conformance inspection

Subclause number and test[a]	D[d] or ND	Conditions of test[a]	*IL*[d]	*n*[d]	*c*[d]	Performance requirements[a]
Group A inspection (lot-by-lot)						
Subgroup A1	ND		S-3[e]	[e]	0	
4.4 Visual examination						As in 4.4.2 Legible marking and as specified in 1.5 of this specification
4.4 Dimensions (detail)[b]						As specified in Table 1 of this specification
Subgroup A2	ND		S-3[e]	[e]	0	
4.5.1 Leakage current		Protective resistance: 1 000 Ω				≤ 0,25 CU µA/ µF × V or 1 µA, whichever is greater
4.5.2 Capacitance		Frequency:... Hz				Within specified tolerance
4.5.3 Tangent of loss angle (tan δ)		Frequency:... Hz				As in 4.5.3
Group B inspection (lot-by-lot)						
Subgroup B1	D		S-3[e]	[e]	0	
4.5.4 Impedance (if applicable)		Frequency: ... Hz				As specified in Table 3 of this specification
4.7 Solderability		Test method: solder bath or reflow Solder composition: ... Flux type for solder bath: non activated or activated Solder bath temperature or reflow temperature profile: ...				
4.7.2 Final measurements		Visual examination				As in 4.7.2
4.21 Solvent resistance of the marking[c] (if applicable)		Solvent:... Solvent temperature:... Method 1 Rubbing material: cotton wool Recovery time:...				Legible marking

[a] Subclause number of tests and performance requirements refer to the sectional specification, IEC 60384-18, and Clause 1 of this specification.

[b] 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.

[c] This may be carried out on the capacitors mounted on a substrate.

[d] In this table:
IL = inspection level (IEC 60410)
n = sample size
c = permissible number of non-conforming items
p = periodicity in months
D = destructive
ND = non-destructive

[e] Number to be tested: sample size as directly allotted to the code letter for *IL* in Table 2A of IEC 60410.

Table 5 *(continued)*

Subclause number and test[a]	D[d] or ND	Conditions of test[a]	Sample size and criterion of acceptability[d]			Performance requirements[a]
			p	*n*	*c*	
Group C inspection (periodic)						
Subgroup C1	D		3	12	0	
4.6 Resistance to soldering heat		Temperature profile:... Recovery: 24 h ± 2 h				
4.6.3 Final measurements		Visual examination				As in 4.6.3
		Capacitance tangent of loss angle				} See detail specification
4.20 Component solvent resistance (if applicable)		Solvent:... Solvent temperature:... Method 2 Recovery:...				See detail specification
Subgroup C2	D		3	12	0	
4.9 Substrate bending test (formerly bond strength of the end face plating)**		Capacitance and impedance (with board in bent position)				See detail specification
Final measurement		Visual examination				No visible damage and no leakage of electrolyte
Subgroup C3	D					
4.3 Mounting		Substrate material:...*				
		Visual examination				No visible damage and no leakage of electrolyte
		Leakage current				≤ 0,025 CU µA/ µF × V or 1 µA, whichever is greater
		Capacitance				$\Delta C/C \leq 5$ % of value measured initially
		Tangent of loss angle				As in 4.5.3
		Impedance (if applicable)				As in Table 3
Subgroup C3.1	D		6	18	0	
4.8 Shear test (formerly adhesion)		Visual examination				No visible damage
4.10.1 Initial measurement		Capacitance (the value obtained) in Subgroup C3 may be used)				
4.10 Rapid change of temperature		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		Visual inspection				No visible damage and no leakage of electrolyte
4.11 Climatic sequence						
4.11.1 Initial measurement		Not required (see 4.10.1)				
4.11.2 Dry heat		Temperature: upper category temperature Duration: 16 h				

The explanation of footnotes to tables is given at the beginning of Table 5.

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

** Not applicable to chip capacitors, which according to their detail specification shall only be mounted on alumina substrates.

Table 5 *(continued)*

Subclause number and test[a]	D[d] or ND	Conditions of test[a]	Sample size and criterion of acceptability[d]			Performance requirements[a]
			p	*n*	*c*	
4.11.3 Damp heat, cyclic, Test Db, first cycle						
4.11.4 Cold		Temperature: lower category temperature Duration: 2 h				
4.11.5 Damp heat, cyclic, Test Db, remaining cycles		Recovery: 1 h to 2 h				
4.11.6 Final measurements		Visual examination				No visible damage and no leakage of electrolyte Legible marking
		Leakage current				≤ initial limit
		Capacitance				$\Delta C/C$ ≤ 10 % of value measured in 4.11.1
		Tangent of loss angle				≤ 1,2 times initial limit
Subgroup C3.2	D		6	9	0	
4.12 Damp heat, steady state		Recovery: 1 h to 2 h				
4.12.1 Initial measurement		Capacitance (the value obtained in Sub-group C3 may be used)				
4.12.2 Final measurements		Visual examination				No visible damage and no leakage of electrolyte Legible marking
		Leakage current				≤ initial limit
		Capacitance				$\Delta C/C$ ≤ 20 % of value measured in 4.12.1
		Tangent of loss angle				≤ 1,2 times initial limit
		Impedance				≤ 1,2 times limit in Table 3
Subgroup C3.3	D		3	24	0	
4.15 Endurance		Duration: 1 000 h Test temperature: Upper category temperature Applied voltage:... V Recovery: 1 h to 2 h				
4.15.1 Initial measurement		Capacitance (the value obtained in Subgroup 3 may be used)				
4.15.3 Final measurements		Visual examination				No visible damage and no leakage of electrolyte Legible marking
		Leakage current				≤ initial limit
		Capacitance				$\Delta C/C$ compared to values measured in 4.15.1
						Rated voltage V: $\Delta C/C$ % U_R≤6,3: +25 to -40 6,3 < U_R ≤ 63: ± 30
The explanation of footnotes to tables is given at the beginning of Table 5.						

Table 5 *(continued)*

Subclause number and test[a]	D[d] or ND	Conditions of test[a]	Sample size and criterion of acceptability[d]			Performance requirements[a]
			p	*n*	*c*	
		Tangent of loss angle				≤ 2 times initial limit or ≤ 0,4 whichever is the greater
		Impedance				≤ 4 times limit in Table 3
Subgroup C3.4						
4.13 Characteristics at high and low temperature		The capacitors shall be measured at each temperature step				
		Step 1: 20 °C				
		Capacitance*				For use as reference value
		Impedance (at same frequency as Step 2)				For use as reference value
		Tangent of loss angle*				
		Step 2: Lower category temperature				
		Impedance				Ratio with respect to value in Step 1: ≤ 2 times
						Rated voltage V / Ratio of impedance: $U_R \leq 6{,}3$ V: ≤ 10; $6{,}3 < U_R \leq 16$ V: ≤ 8; $16 < U_R \leq 63$ V: ≤ 6
		Step 3: Upper category temperature				
		Leakage current				At 125 °C: ≤ 10 times the limit of 4.5.1 At 105 °C: ≤ 8 times the limit of 4.5.1 At 100 °C: ≤ 8 times the limit of 4.5.1 At 85 °C: ≤ 5 times the limit of 4.5.1
		Capacitance*				See detail specification
		Tangent of loss angle*				See detail specification
4.19 Charge and discharge (if required)		Temperature: 20 °C Number of cycles: 10^6 Duration of charge: 0,5 s Duration of discharge: 0,5 s				
		Visual examination				No visible damage and no leakage of electrolyte
4.19.3 Final measurements		Leakage current				≤ initial limit
		Capacitance				$\Delta C/C$ ≤ 10 % of value measured in Step 3 of 4.13
The explanation of footnotes to tables is given at the beginning of Table 5.						
* If applicable.						

Table 5 *(continued)*

Subclause number and test[a]	D[d] or ND	Conditions of test[a]	Sample size and criterion of acceptability[d]			Performance requirements[a]
			p	*n*	*c*	
Subgroup C3.5A	D		12	6	0	
4.17 Storage at high temperature		Temperature: upper category temperature Duration: 96 h ± 4 h Recovery: 16 h min				
4.17.1 Initial measurement		Capacitance (value obtained in Subgroup C3 may be used)				
4.17.3 Final measurement		Visual examination				No visible damage and no leakage of electrolyte
		Leakage current				≤ 2 times initial limit
		Capacitance				$\Delta C/C$ ≤ 10 % of value measured in 4.17.1
		Tangent of loss angle				≤ 1,2 times initial limit
4.18 Storage at low temperature*		Duration: 16 h, or 4 h after thermal stability has been reached (whichever is the shorter) Temperature: –40 °C Recovery: 1 h to 2 h				
4.18.1 Initial measurements		Capacitance				
4.18.2 Final measurements		Visual examination				No visible damage and no leakage of electrolyte Legible marking
		Leakage current				≤ initial limit
						$\Delta C/C$ ≤ 10 % of value measured in 4.18.1
		Tangent of loss angle				≤ initial limit
4.14 Surge		Number of cycles: 1 000 Temperature:... °C Voltage: 1,15 U_R or 1,15 U_C Protective resistor: RC = 0,1 s ± 0,05 s Duration of charge: 30 s Duration of no-load: 5 min 30 s				
4.14.3 Final measurements		Visual examination				No visible damage and no leakage of electrolyte
		Leakage current				≤ initial limit
		Capacitance				Value measured in 4.17.3 or 4.18.2: $\Delta C/C$ ≤ 15 %
		Tangent of loss angle				≤ initial limit
Subgroup C3.5B	D		6	12	0 | 0	
4.17 Reverse voltage (If applicable)		Duration: 125 h at upper category temperature with a direct voltage of 0,15 U_C in reverse polarity direction, followed by 125 h at upper category temperature with category voltage in forward polarity direction				
The explanation of footnotes to tables is given at the beginning of Table 5.						
* Only applicable to capacitors with a lower category temperature of –25 °C and –10 °C.						

Table 5 *(continued)*

Subclause number and test[a]	D[d] or ND	Conditions of test[a]	Sample size and criterion of acceptability[d]			Performance requirements[a]
			p	*n*	*c*	
4.16.1 Initial measurement		Capacitance (the value obtained in subgroup C3 may be used				
4.16.3 Final measurements		Leakage current				≤ initial limit
		Capacitance				See detail specification
		Tangent of loss angle				≤ initial limit

[a] Subclause number of tests and performance requirements refer to the sectional specification, IEC 60384-18, and Clause 1 of this specification.

[d] In this table:
IL = inspection level (IEC 60410)
n = sample size
c = permissible number of nonconforming items
p = periodicity in months
D = destructive
ND = non-destructive

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 When 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)	- [1)]	Fixed capacitors for use in electronic equipment - Part 1: Generic specification	EN 60384-1 + corr. October	2001 [2)] 2001
IEC 60384-18	- [1)]	Fixed capacitors for use in electronic equipment - Part 18: Sectional specification - Fixed aluminium electrolytic surface mount capacitors with solid (MnO_2) and non-solid electrolyte	EN 60384-18	2007 [2)]
IEC 60410	- [1)]	Sampling plans and procedures for inspection by attributes		-

[1)] Undated reference.

[2)] Valid edition at date of issue.

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