BRITISH STANDARD

BS EN
60384-4-2:2007
Incorporating corrigendum April 2009

Fixed capacitors for use in electronic equipment —

Part 4-2: Blank detail specification — Fixed aluminium electrolytic capacitors with solid (MnO_2) electrolyte — Assessment level EZ

ICS 31.060.50

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 60384-4-2:2007, incorporating corrigendum April 2009. It is identical to IEC 60384-4-2:2007. Together with BS EN 60384-4:2007 and BS EN 60384-4-1:2007 it supersedes BS QC 300300:1998 which is withdrawn. Together with BS EN 60384-4-1:2007 it partially supersedes BS EN 130301:2002, which is withdrawn.

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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60384-4-2

May 2007

ICS 31.060.50

Incorporating Corrigendum April 2009

English version

Fixed capacitors for use in electronic equipment - Part 4-2: Blank detail specification - Fixed aluminium electrolytic capacitors with solid (MnO_2) electrolyte - Assessment level EZ

(IEC 60384-4-2:2007)

Condensateurs fixes utilisés dans les équipements électroniques - Partie 4-2: Spécification particulière cadre - Condensateurs fixes électrolytiques en aluminium à électrolyte solide (MnO_2) - Niveau d'assurance de la qualité EZ

(CEI 60384-4-2:2007)

Festkondensatoren zur Verwendung in Geräten der Elektronik - Teil 4-2: Vordruck für Bauartspezifikation - Aluminium-Elektrolyt-Kondensatoren mit festem (MnO_2) Elektrolyten - Bewertungsstufe EZ

(IEC 60384-4-2:2007)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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Europäisches Komitee für Elektrotechnische Normung

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

Ref. No. EN 60384-4-2:2007 E

Foreword

The text of document 40/1763/CDV, future edition 2 of IEC 60384-4-2, 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 60384-4-2 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 60384-4-2:2007 was approved by CENELEC as a European Standard without any modification.

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FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 4-2: Blank detail specification – Fixed aluminium electrolytic capacitors with solid (MnO2) electrolyte – Assessment level EZ

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 contents 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, data 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 60384-4-2- XXX [2] QC 300302- XXX
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH: IEC 60384-1 IEC 60384-4 [3]	IEC 60384-4-2 [4] QC 300302
	FIXED ALUMINIUM ELECTROLYTIC CAPACITORS WITH SOLID (MnO_2) ELECTROLYTE [5]
Outline drawing: (see Table 1) (…angle projection) [7] (Other shapes are permitted within the dimensions given.)	[6]
	Assessment level(s): EZ [8] Performance grade:

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

[9]

1 General data

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

See 1.4.2 of IEC 60384-4.

1.2 Di006Densions

Table 1 – Case size reference and dimensions

Case size reference	Dimensions 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

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)

NOTE Instead of the tangent of loss angle (tan δ), the equivalent series resistance ESR may be specified in accordance with 4.3.3.2d) of IEC 60384-4.

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*				
	Case size	Case size	Case size	Case size
Rated capacitance µF				

* If different from the rated voltage.

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

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

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 60384-4, *Fixed capacitors for use in electronic equipment – Part 4: Sectional specification: Aluminium electrolytic capacitors with solid (MnO2) and non-solid electrolyte*

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

1.5 Marking

The marking of the capacitor and the package shall be in accordance with the requirements of 1.6 of IEC 60384-4.

The details of the marking of the component and package are 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.

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 IEC 60384-4.

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[c] or ND[c]	Conditions of test [a]	*IL* [c]	*n* [c]	*c* [c]	Performance requirements [a]
Group A inspection (lot-by-lot)						
Subgroup A0	ND		100 %[e]			
4.21 High surge current (if required by the detail specification)						
Subgroup A1	ND		S-3[d]	[d]	0	
4.2 Visual examination						As in 4.2 Legible marking and as specified in 1.5 of this specification
4.2 Dimensions (gauging)						As specified in Table 1 of this specification
Subgroup A2	ND		S-3[d]	[d]	0	
4.3.1 Leakage		Protective resistance:.... Ω				As in 4.3.1.2
4.3.2 Capacitance		Frequency:.... Hz				Within specified tolerance
4.3.3 Tangent of loss angle		Frequency:.... Hz				As in 4.3.3.2
4.3.4 Impedance (if applicable)		Frequency:.... Hz				Within limit specified in the detail specification

[a] Subclause number of tests and performance requirements refer to IEC 60384-4 and Clause 1 of this specification.

[b] Not applicable to capacitors with screw terminations or other terminations not designed to be soldered, as stated in the detail specifications.

[c] 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

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

[e] 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 nonconforming item. If one or more nonconforming items occur in a sample, this lot shall be rejected.

Table 5 *(continued)*

Subclause number and test [a]	D[c] or ND [c]	Conditions of test [a]	*IL* [c]	*n* [c]	*c* [c]	Performance requirements [a e]
Group B inspection (lot-by-lot) *Subgroup B1* 4.6 Solderability[b]	ND	Method:.....	S-3[d]	[d]	0	Good tinning as evidenced by free flowing of the solder with wetting of the terminations or meet the required parameter(s) in the detail specification as applicable
Subgroup B2 4.19 Characteristics at high and low temperature	ND	The capacitors shall be measured at each temperature step *Step 1:* 20 °C Impedance (at same frequency as Step 2) *Step 2:* Lower category temperature Impedance	S-3[d]	[d]	0	Ratio with respect to value in Step 1: ≤2 times

[a] Subclause number of tests and performance requirements refer to IEC 60384-4 and Clause 1 of this specification.

[b] Not applicable to capacitors with screw terminations or other terminations not designed to be soldered, as stated in the detail specifications.

[c] 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

[d] 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 or ND	Conditions of test [a]	Sample size and criterion of acceptability [c]			Performance requirements [a]
			p	*n*	*c*	
Group C inspection (periodic)						
Subgroup C1A Part of sample of subgroup C1	D		6	9	0	
4.2 Dimensions (detail)						See detail specification
4.4.1 Initial measurement		Capacitance				
4.4 Robustness of terminations		Visual examination Method:..... Severity:.....				No visible damage
4.5 Resistance to soldering heat*		No pre-drying Method:.....				
4.5.2 Final measurements		Visual examination				No visible damage Legible marking
		Capacitance				$\Delta C/C$ ≤5 % of value measured in 4.4.1
Subgroup C1B Other part of sample of group C1	D		6	18	0	
4.7.1 Initial measurement		Capacitance				
4.7 Rapid change of temperature		T_A = lower category temperature T_B = upper category temperature Five cycles Duration t_1 = 30 min or 3 h Recovery: 16 h				
4.7.3 Final measurements		Visual examination				No visible damage
		Leakage current				As in 4.3.1
		Tangent of loss angle				As in 4.3.3
		Impedance				Within the limit specified in the detail specification
4.8 Vibration		Method of mounting: see 1.1 of this specification Frequency range: ..... Hz to..... Hz Amplitude:..... mm or acceleration:..... m/s^2 (whichever is the less severe) Total duration:..... h				
4.8.2 Final measurements		Visual examination				No visible damage Legible marking
		Capacitance				$\Delta C/C$ ≤5 % of value measured in 4.7.1, unless otherwise specified in the detail specification

* Not applicable to capacitors with screw terminations or other terminations not designed to be soldered, as stated in the detail specification.

Table 5 *(continued)*

Subclause number and test [a]	D or ND	Conditions of test [a]	Sample size and criterion of acceptability [c]			Performance requirements [a]
			p	***n***	***c***	
Subgroup C1B (concluded)						
4.9 Bump (or shock, see 4.10)		Method of mounting: see 1.1 of this specification				
		Number of bumps:..... Acceleration: 400 m/s^2 Duration of pulse: 6 ms				
4.10 Shock (or bump, see 4.9)		Method of mounting: see 1.1 of this specification				
		Acceleration:..... m/s^2 Duration of pulse:..... ms				
4.9.2 or 4.10.2 Final measurements		Visual examination				No visible damage and no leakage of electrolyte
		Capacitance				$\Delta C/C$ ≤5 % of value measured in 4.7.1, unless otherwise specified in the detail specification
Subgroup C1	D		6	27	0	
Combined sample of specimens of subgroups C1A and C1B						
4.11 Climatic sequence						
4.11.1 Dry heat		Temperature: upper category temperature Duration: 16 h				
4.11.2 Damp heat, cyclic, test Db, first cycle						
4.11.3 Cold		Temperature: lower category temperature Duration: 2 h				
4.11.4 Low air pressure (if required by the detail specification)		Air pressure: 8 kPa				
4.11.4.3 Intermediate measurement		Visual examination				No breakdown, flashover or harmful deformation of the case
4.11.5 Damp heat, cyclic, Test Db, remaining cycles						
4.11.6 Sealing (if required by the detail specification)		Method:.....				
4.11.7 Final measurements		Visual examination				No visible damage. Legible marking
		Leakage current				As in 4.3.1
		Capacitance				$\Delta C/C$ for: **Long life grade**: ≤5 % **General purpose grade**: ≤10 % of value measured in 4.5.2, 4.9.2 or 4.10.2 as applicable
		Tangent of loss angle				≤1,2 times limit in 4.3.3

Table 5 *(continued)*

Subclause number and test [a]	D or ND	Conditions of test [a]	Sample size and criterion of acceptability [c]			Performance requirements [a]
			p	***n***	***c***	
Subgroup C2	D		6	9	0	
4.12 Damp heat, steady state						
4.12.1 Initial measurement		Capacitance				
4.12.2 Final measurements		Visual examination				No visible damage and no leakage of electrolyte Legible marking
		Leakage current				As in 4.3.1
		Capacitance				$\Delta C/C$ for: ***Long-life grade:*** ≤5 % ***General-purpose grade:*** ≤10 % of value measured in 4.12.1
		Tangent of loss angle				≤1,2 times limit in 4.3.3
		Impedance				≤1,2 times limit in the detail specification
		Insulation resistance of the external insulation (if applicable)				≥100 MΩ
		Voltage proof of the external insulation (if applicable)				No breakdown or flashover
Subgroup C3	D		3	21	0	
4.13 Endurance		Duration: ... h Temperature: upper category temperature Applied voltage:..... V Recovery: 16 h min.				
4.13.1 Initial measurement		Capacitance				
4.13.3 Final measurements		Visual examination				No visible damage
		Leakage current				As in 4.3.1
		Capacitance				$\Delta C/C$ ≤10 % of the values measured in 4.13.1
		Tangent of loss angle				≤1,2 times the limit in 4.3.3
		Impedance				≤1,2 times limit in detail specification
		Insulation resistance of the external insulation (if applicable)				≥100 MΩ
		Voltage proof of the external insulation (if applicable)				No breakdown or flashover

Table 5 *(continued)*

Subclause number and test [a]	D or ND	Conditions of test [a]	Sample size and criterion of acceptability [c]				Performance requirements [a]
			p	***n***	***c***		
Subgroup C4A	D		12	6	0		
4.14 Surge		Number of cycles: 1 000 Temperature:..... °C Charge voltage: 1,15 U_R or 1,15 U_C for U_R ≤315 V or 1,10 U_R or 1,10 U_C for U_R >315 V Duration of charge: 30 s Duration of non-load: 5 min 30 s					
4.14.1 Initial measurement		Capacitance					
4.14.3 Final measurements		Leakage current					As in 4.3.1
		Capacitance					$\Delta C/C$ for: **Long life grade**: ≤5 % **General purpose grade**: ≤10 % of value measured in 4.14.1
		Tangent of loss angle					As in 4.3.3
Subgroup C4B	D		12	6	0	0	
4.15 Reverse voltage (if required)		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					
4.15.1 Initial measurement		Capacitance					
4.15.3 Final measurements		Leakage current					As in 4.3.1
		Capacitance					$\Delta C/C$ ≤10 % of value measured in 4.15.1
		Tangent of loss angle					As in 4.3.3
Subgroup C5	ND		6	12	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					
4.17.3 Final measurements		Visual examination					No visible damage
		Leakage current					As in 4.3.1
		Capacitance					$\Delta C/C$ ≤ 5 % of value measured in 4.17.1
		Tangent of loss angle					As in 4.3.3

* Not applicable if test is made in subgroup B1.

Table 5 *(continued)*

Subclause number and test [a]	D or ND	Conditions of test [a]	Sample size and criterion of acceptability [c]			Performance requirements [a]
			p	***n***	***c***	
Subgroup C6	D		6	15	0	
4.19 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
		Tangent of loss angle*				For use as reference value
		Impedance (at same frequency as Step 2)				
		Step 2: Lower category temperature				
		Capacitance				$\Delta C/C$ ≤20 % of the value measured in 4.15.1
		Impedance				Ratio with respect to values in Step 1: ≤ 2 times
		Tangent of loss angle				≤2 times the limit in 4.3.3
		Step 3: Upper category temperature				
		Leakage current				At 125 °C: ≤15 times the limit of 4.3.1 At 105 °C: ≤8 times the limit of 4.3.1 At 100 °C: ≤12,5 times the limit of 4.3.1 At 85 °C: ≤10 times the limit of 4.3.1*
		Capacitance*				$\Delta C/C$ ≤20 % of the value measured in Step 1
		Tangent of loss angle*				≤ the limit in 4.3.3
4.20 Charge and discharge (if required)		Temperature: 20 °C Number of cycles: U_R ≤ 160 V: 10^6 U_R > 160 V: under consideration Duration of charge: 0,5 s Duration of discharge: 0,5 s				
4.20.1 Initial measurement		Capacitance				
4.20.3 Final measurements		Visual examination				No visible damage
		Capacitance				$\Delta C/C$ ≤5 % of value measured in 4.20.1

* If applicable

[a] Subclause numbers of tests and performance requirements refer to the sectional specification, IEC 60384-4 and Clause 1 of this specification.

[b] Inspection Levels are selected from IEC 60410.

[c] In this table,

- *p* is the periodicity (in months);
- *n* is the sample size;
- *c* is the acceptance criterion (permitted number of non conforming items);
- D is destructive
- ND is non-destructive;
- *IL* is inspection level (IEC 60410).

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 60384-4	-[1)]	Fixed capacitors for use in electronic equipment - Part 4: Sectional specification - Aluminium electrolytic capacitors with solid (MnO_2) and non-solid electrolyte	EN 60384-4	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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