

# INTERNATIONAL STANDARD

**IEC**  
**62391-2-1**

First edition  
2006-04

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**Fixed electric double-layer capacitors  
for use in electronic equipment –**

**Part 2-1:  
Blank detail specification –  
Electric double-layer capacitors  
for power application –  
Assessment level EZ**



Reference number  
IEC 62391-2-1:2006(E)

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## **Fixed electric double-layer capacitors for use in electronic equipment –**

### **Part 2-1: Blank detail specification – Electric double-layer capacitors for power application – Assessment level EZ**

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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## FIXED ELECTRIC DOUBLE-LAYER CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

### Part 2-1: Blank detail specification – Electric double-layer capacitors for power application – Assessment level EZ

#### FOREWORD

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International Standard IEC 62391-2-1 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

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

FDIS	Report on voting
40/1642/FDIS	40/1714/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 62391 consists of the following parts, under the general title *Fixed electric double-layer capacitors for use in electronic equipment*:

Part 1: Generic specification

Part 2: Sectional specification – Electric double-layer capacitors for power application

The sectional specification mentioned above does have a blank detail specification 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- withdrawn;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.

# FIXED ELECTRIC DOUBLE-LAYER CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

## Part 2-1: Blank detail specification – Electric double-layer capacitors for power application – Assessment level EZ

### INTRODUCTION

#### 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 of the detail specification 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 circuit-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.
- [9] Reference data on the most important properties, to allow comparison between the various capacitor types.

[1]	IEC 62391-2-1-XXX QC XXXXXXXXXXXX	[2]
ELECTRONIC COMPONENTS OF ASSESSED QUALITY IN ACCORDANCE WITH:  [3]	IEC 62391-2-1 QC XXXXXX	[4]
	ELECTRIC DOUBLE-LAYER CAPACITORS FOR POWER APPLICATION	
Outline drawing: (see Table 1) (...angle projection)  [7]		[5]
		[6]
	Assessment level(s): EZ	[8]
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 1.4.2 of IEC 62391-2.

### 1.2 Dimensions

Dimensions are given in Table 1.

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

Case size reference	Dimensions mm						
	$\varnothing$	$W$	$H$	$d$	.....		
NOTE 1 When there is no case size reference, Table 1 may be omitted and the dimensions should be given in Table 2a, 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 2a).

Tolerance on rated capacitance.

Rated voltage (see Table 2a).

Climatic category.

Rated temperature.

Internal resistance (see Table 2b).

Leakage current (if applicable).

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

Rated voltage				
Rated capacitance F	Case sizes	Case sizes	Case sizes	Case sizes

**Table 2b – Values of internal resistance and leakage current**

$U_R$ V	$C_R$ F	Internal resistance at ... °C	Leakage current $\mu A$ (if applicable)		



## 1.4 Normative references

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

IEC 62391-1, *Fixed electric double-layer capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 62391-2, *Fixed electric double-layer capacitors for use in electronic equipment – Part 2: Sectional specification – Electric double-layer capacitors for power application*

IEC QC 001005, *Rules of procedure – Part 5: Hazardous substances process management requirements*

## 1.5 Marking

The marking of the capacitor and the package shall be in accordance with the requirements of 1.6 of IEC 62391-2.

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 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 IEC 62391-2.

**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 IEC 62391-2.

**Table 4 – Test schedule for quality conformance inspection**

Subclause number and test <sup>a</sup>	D or ND <sup>b</sup>	Conditions of test <sup>a</sup>	Number of specimens and number of non-conforming items <sup>b</sup>			Performance requirements <sup>a</sup>
			IL	<i>n</i>	<i>c</i>	
<b>Group A inspection</b> (lot-by-lot)  <b>Subgroup A0</b> 4.4.2 Capacitance 4.4.3 Internal resistance 4.4.1 Leakage current (if applicable)	ND	According to Class 3 DC resistance: according to Class 3 <sup>f</sup> Protective resistor $\Omega$	100 % <sup>c</sup>			Within specified tolerance As in Table 2b As in Table 2b
<b>Subgroup A1</b> 4.3 Visual examination	ND		S-3	<sup>d</sup>	0	As in 4.3.2 Legible marking and as specified in the detail specification
<b>Subgroup A2</b> 4.3 Dimension (detail) <sup>e</sup>	ND		S-3	<sup>d</sup>	0	As specified in Table 1 of this specification
<b>Group B inspection</b> (lot-by-lot)  <b>Subgroup B1</b> 4.7 Solderability <sup>g</sup> 4.7.1 Final measurement	D	Test method: Solder bath method (Method 1) Visual examination	S-3	<sup>d</sup>	0	75 %, or more, of terminals shall be covered with new solder
<b>Subgroup B2</b> 4.13 Characteristics at high and low temperature	ND	Step 1: 20 °C Capacitance Internal resistance Step 2: –25 °C Capacitance Internal resistance	S-3	<sup>d</sup>	0	$\Delta C/C \leq 30\%$ of value measured in Step 1 $\leq 4$ times the limit specified in 4.4.3

<b>Group C inspection</b> (Periodic) <b>Subgroup C1A</b> 4.3 Dimension (detail) 4.5 Robustness of terminations 4.5.1 Initial measurement 4.5.2 Final measurement 4.6 Resistance to soldering heat <sup>9</sup> 4.6.1 Initial measurement 4.6.3 Final measurement	D	Test method: Test $U_{a1}$ (tensile strength) Test $U_b$ (bending strength) Capacitance Visual examination  Capacitance  Method 1a of Test Tb Recovery: ...  Capacitance  Visual examination  Capacitance	12	8	0 <sub>h</sub>	As specified in Table 1 of this specification   No visible damage Legible marking $\Delta C/C \leq 10\%$ of value measured in 4.5.1   No visible damage Legible marking and no leakage of electrolyte $\Delta C/C \leq 10\%$ of value measured in 4.6.1
<b>Subgroup C1B</b> Part of sample of Subgroup C1 4.8 Rapid change of temperature 4.8.1 Initial measurement 4.8.3 Final inspection 4.9 Vibration 4.9.1 Initial measurement 4.9.3 Final inspection	D	$T_A$ = Lower category temperature $T_B$ = Upper category temperature 5 cycles Test time $t_1$ = .... Visual examination capacitance Visual examination capacitance  Mounting method: see 1.4.2 Capacitance (the value obtained in 4.8.3 may be used) Visual examination  Capacitance	12	8	0 <sub>h</sub>	   No visible damage and no leakage of electrolyte $\Delta C/C \leq 10\%$ of value measured in 4.8.1 for capacitance   No visible damage, marking to be legible and no leakage of electrolyte $\Delta C/C \leq 10\%$ of value measured in 4.9.1

<b>Subgroup C2</b> 4.10 Endurance  4.10.1 Initial measurement 4.10.3 Final measurements	ND	Duration: 1 000 h for upper category temperature 70 °C grade capacitors. 2 000 h for upper category temperature 60 °C grade capacitors. Voltage: ... V Recovery: 16 h min. Capacitance Visual examination  Capacitance Internal resistance	6	16	0 h	No visible damage and no leakage of electrolyte  $\Delta C/C \leq 30\%$ of value measured in 4.10.1 $\leq 4$ times the limit specified in 4.4.3
<b>Subgroup C3A</b> 4.11 Self-discharge  4.11.2 Final measurements  4.12 Storage at high temperature  4.12.3 Final measurements	D	Charge voltage : ..... Charge time: 8 h Retention voltage  Test temperature: upper category temperature Duration: 96 h $\pm$ 4 h Recovery: 16 h min. Visual examination  Capacitance Internal resistance	6	8	0 h	Retention voltage after a 24-hour exposure at room temperature after charge shall be 80 % or more of the charge voltage  No visible damage and no leakage of electrolyte  $\Delta C/C \leq 10\%$ of value measured in 4.12.1 $\leq 2$ times the limit specified in 4.4.3
<b>Subgroup C3B</b> 4.14 Damp heat, steady state  4.14.1 Initial measurement 4.14.3 Final measurements	D	Temperature, humidity: 40 °C, 90 % to 95 % Time: 10 days Capacitance Visual examination  Capacitance Internal resistance	6	8	0 h	No visible damage, and no leakage of electrolyte  $\Delta C/C \leq 30\%$ of value measured in 4.14.1 $\leq 4$ times the limit specified in 4.4.3

<b>Subgroup C4</b>	D		12	8	0	
4.13 Characteristics at high and low temperature		The capacitors shall be measured at each temperature step  Step 1: 20 °C Capacitance Step 2: lower category temperature Capacitance  Internal resistance  Step 3: upper category temperature Capacitance  Internal resistance			h	For use as reference value  $\Delta C/C \leq 30\%$ of value measured in Step 1  $\leq 4$ times the limit specified in 4.4.3  $\Delta C/C \leq 30\%$ of value measured in Step 1  $\leq$ the limit specified in 4.4.3
<b>Subgroup C4A</b>	D					
4.15 Passive flammability (if applicable)		Category of flammability : .....	12	4	0	As in 4.15.1
<b>Subgroup C4B</b>	D					
4.16 Pressure relief (if applicable)		Applied voltage : .....	12	4	0	As in 4.16.1
<p><sup>a</sup> Subclause numbers of tests and performance requirements refer to the sectional specification, IEC 62391-2, and Clause 1 of this specification.</p> <p><sup>b</sup> In this table, <math>p</math> = periodicity (in months); <math>n</math> = sample size; <math>c</math> = acceptance criterion (permitted number of non-conforming items); D = destructive; ND = non-destructive; <math>IL</math> = inspection level.</p> <p><sup>c</sup> 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. If one or more non-conforming items occur in a sample, this lot shall be rejected.</p> <p><sup>d</sup> Inspection levels are selected from IEC 60410.</p> <p><sup>e</sup> 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.</p> <p><sup>f</sup> The a.c. resistance method shall be used when a correlation is found with the results of the d.c. measuring method. The measuring method shall be in accordance with 4.6.1 of IEC 62391-1.</p> <p><sup>g</sup> Not applicable to capacitors with screw terminations or other terminations not designed to be soldered, as stated in the detail specification.</p> <p><sup>h</sup> 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 the product may continue during repeat testing.</p>						

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