

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

Fixed capacitors for use in electronic equipment –  
Part 17: Sectional specification – Fixed metallized polypropylene film dielectric  
AC and pulse capacitors (standards.iteh.ai)

IEC 60384-17:2019  
Condensateurs fixes utilisés dans les équipements électroniques –  
Partie 17: Spécification intermédiaire – Condensateurs fixes pour tension  
alternative et pour impulsions à diélectrique en film de polypropylène métallisé



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Partie 17: Spécification intermédiaire – Condensateurs fixes pour tension  
alternative et pour impulsions à diélectrique en film de polypropylène métallisé**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
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**FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –****Part 17: Sectional specification – Fixed metallized polypropylene film dielectric AC and pulse capacitors**

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International Standard IEC 60384-17 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This third edition cancels and replaces the second edition published in 2005. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) all parts of the document have been revised based on the ISO/IEC Directives, Part 2:2016 (seventh edition) and harmonization between other similar kinds of documents;
- b) tables and Clause 4 have been revised so as to prevent duplications and contradictions;
- c) new damp heat steady-state robustness classes with test conditions have been added in text, in Clause 4 and in Annex A.



The text of this International Standard is based on the following documents:

FDIS	Report on voting
40/2654/FDIS	40/2664/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all parts of the IEC 60384 series, under the general title *Fixed capacitors for use in electronic equipment*, can be found on the IEC web site.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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## FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

### Part 17: Sectional specification – Fixed metallized polypropylene film dielectric AC and pulse capacitors

#### 1 General

##### 1.1 Scope

This part of IEC 60384 applies to fixed capacitors with metallized electrodes and polypropylene dielectric for use in electronic equipment.

NOTE Capacitors that have mixed film and metallized electrodes are also within the scope of this standard.

These capacitors may have "self-healing" properties depending on conditions of use.

Capacitors covered by this specification are mainly intended for use with alternating voltage and/or for pulse applications. The maximum reactive power applicable is 10 000 var and the maximum peak voltage is 3 000 V.

Capacitors for reactive power exceeding 500 var, and to which a maximum peak voltage of 2 500 V at 50 Hz can be applied, are not covered by this document, except when they are the highest part of a range of reactive power mainly situated below 500 var at 50 Hz.

This document is not intended to cover capacitance values higher than 20  $\mu\text{F}$ .

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Two performance grades of capacitors are covered, Grade 1 for long-life application and Grade 2 for general application.

Capacitors for electromagnetic interference suppression are not included, but are covered by IEC 60384-14.

Capacitors for electrical shock hazard protection (covered by IEC 60065 of IEC technical committee 61) and fluorescent lamp and motor capacitors (covered by IEC 60252-1 and IEC 60252-2 of IEC technical committee 33), and capacitors for use in tubular fluorescent and other discharge lamp circuits (covered by IEC 61048 and IEC 61049 of IEC technical committee 34) are also excluded.

##### 1.2 Object

The object of this document is to prescribe preferred ratings and characteristics and to select from IEC 60384-1:2016, the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements prescribed in detail specifications referring to this sectional specification shall be of equal or higher performance level. Lower performance levels are not permitted.

##### 1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60062, *Marking codes for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60384-1:2016, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60384-16, *Fixed capacitors for use in electronic equipment – Part 16: Sectional specification: Fixed metallized polypropylene film dielectric d.c. capacitors*

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

ISO 3, *Preferred numbers – Series of preferred numbers*

## 1.4 Information to be given in a detail specification

### 1.4.1 General

Detail specifications shall be derived from the blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic, sectional or blank detail specification. When more severe requirements are included, they shall be listed in 1.9 of the detail specification and indicated in the test schedules, for example by an asterisk.

The information given in 1.4.2 may, for convenience, be presented in tabular form.

The information in 1.4.2 to 1.4.4 shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this sectional specification.

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### 1.4.2 Outline drawing and dimensions

There shall be an illustration of the capacitor as an aid to easy recognition and for comparison of the capacitor with others. Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification. All dimensions shall preferably be stated in millimetres. However, when the original dimensions are given in inches, the converted metric dimensions in millimetres shall be added.

The numerical values of the body shall be given as follows:

- general case: width, length and height;
- for cylindrical body: diameter and length.

The numerical values of the terminals shall be given as follows:

- width or diameter, length and spacing.

When necessary, for example when a number of items (sizes and capacitance/voltage ranges) are covered by a detail specification, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information as will adequately describe the capacitor. When the capacitor is not designed for use on printed boards, this shall be clearly stated in the detail specification.

### 1.4.3 Mounting

The detail specification shall specify the method of mounting to be applied for normal use and for the application of the vibration and the bump or shock tests. The capacitors shall be mounted by their normal means. The design of the capacitor may be such that special mounting fixtures are required in its use. In this case, the detail specification shall describe the mounting fixtures and they shall be used in the application of the vibration and bump or shock tests.

### 1.4.4 Ratings and characteristics

#### 1.4.4.1 General

The ratings and characteristics shall be in accordance with the clauses of this specification, including the items as specified in 1.4.4.2 to 1.4.4.5.

#### 1.4.4.2 Nominal capacitance range

See 2.2.1.

When products approved to the detail specification have different nominal capacitance ranges, the following statement should be added: "The nominal capacitance range available in each voltage range is given in the register of approvals, available for example on the IECQ on-line certificate system website, [www.iecq.org](http://www.iecq.org)."

#### 1.4.4.3 Sinusoidal current (if applicable)

The detail specification shall state the derating curve of the sinusoidal current versus temperature with reference to 70 °C, and the derating curve of the sinusoidal current versus frequency and of the sinusoidal current versus capacitance.

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#### 1.4.4.4 Particular characteristics

Additional characteristics may be listed, when they are considered necessary to specify adequately the component for design and application purposes.

#### 1.4.4.5 Soldering

The detail specification shall specify the test methods, severities and requirements applicable for the solderability and the resistance to soldering heat tests.

### 1.4.5 Marking

The detail specification shall specify the content of the marking on the capacitor and on the packaging. When there are deviations from 1.6, these shall be given in the detail specification.

## 1.5 Terms and definitions

### 1.5.1 General

For the purposes of this document, the applicable terms and definitions of IEC 60384-1:2016, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

## 1.5.2 Performance and stability grades

The performance grade describes the capacitor's ability to function in the intended applications. The stability grade describes capacitance drift in tests.

### 1.5.2.1

#### performance grade 1 capacitors

<long-life> capacitors for long-life applications with stringent requirements for the electrical parameters

### 1.5.2.2

#### performance grade 2 capacitors

<general purpose> capacitors for general application where the stringent requirements for grade 1 capacitors are not necessary

### 1.5.2.3

#### stability grade

capacitance drift after climatic and mechanical tests and after endurance tests

Note 1 to entry: The performance grade and the stability grade shall be noted in the detail specification.

### 1.5.2.4

#### performance grade and stability grade combination

designation for combined performance grade and stability grade

Note 1 to entry: Table 1 shows the preferred combination designations.

**Table 1 – Preferred designations of performance grade and stability grade combinations**

Performance grades	Stability grades	Combination designations
1	1	1.1
	2	1.2
2	–	2

The three combinations concern capacitance stability and  $\tan \delta$  values. Distinction in performance of the three combinations is shown in Table 4.

## 1.5.3 Rated voltages

### 1.5.3.1 General

The sum of the DC voltage and the peak AC voltage or the peak pulse voltage applied to the capacitor shall not exceed the rated voltage. The value of the peak AC voltage allowed at different frequencies is under consideration.

### 1.5.3.2

#### rated DC voltage

maximum DC voltage that may be applied continuously to a capacitor at the rated temperature

### 1.5.3.3

#### rated AC voltage

maximum RMS alternating voltage that may be applied continuously to a capacitor at the rated temperature and at a given frequency

### 1.5.3.4

#### rated pulse voltage

peak value of the pulse voltage that may be applied continuously to a capacitor at the rated temperature and at a given frequency

### 1.5.3.5 rated voltage pulse slope

maximum admissible value of the voltage slope  $\frac{dU}{dt}$  of a pulse at the rated temperature at such a repetition frequency that no significant increase of temperature occurs

Note 1 to entry: The formula for rated voltage pulse slope is  $\frac{(dU)}{(dt)_R}$

## 1.6 Marking

### 1.6.1 General

See IEC 60384-1:2016, 2.4, with the details given in 1.6.2 to 1.6.5.

### 1.6.2 Information for marking

Information given in the marking is normally selected from the following list. The relative importance of each item is indicated by its position in the list:

- a) nominal capacitance (in clear or code in accordance with IEC 60062);
- b) rated AC and/or pulse voltage (AC voltage may be indicated by the symbol  $\sim$  (IEC 60417-5032-2002-10)) and the corresponding frequency if different from 50 Hz;
- c) tolerance on nominal capacitance;
- d) rated DC voltage (DC voltage may be indicated by the symbol  $---$  or  $---$  (IEC 60417-5031-2002-10)) (if applicable);
- e) rated voltage pulse slope (if applicable);
- f) rated current and corresponding frequency (if applicable);
- g) year and month (or year and week) of manufacture;
- h) manufacturer's name and/or trade mark;
- i) climatic category;
- j) manufacturer's type designation;
- k) reference to the detail specification.

### 1.6.3 Marking on capacitors

The capacitor shall be clearly marked with a), b) and c) of 1.6.2 with as many as possible of the remaining items as is considered necessary. Any duplication of information in the marking on the capacitor should be avoided.

Any marking shall be legible and not easily smeared or removed by rubbing with a finger.

### 1.6.4 Marking on packaging

The packaging containing capacitor(s) should be clearly marked with all the information listed in 1.6.2 as applicable.

### 1.6.5 Additional marking

Any additional marking shall be so applied that no confusion can arise.

## 2 Preferred ratings and characteristics

### 2.1 Preferred characteristics

#### 2.1.1 General

The values given in detail specifications shall preferably be selected from 2.2.1 to 2.2.8.

#### 2.1.2 Preferred climatic categories

The capacitors covered by this specification are classified into climatic categories in accordance with the general rules given in IEC 60068-1:2013, Annex A.

The lower and upper category temperatures and the duration of the damp heat, steady-state test shall be chosen from the following:

- lower category temperature: –55 °C, –40 °C, –25 °C and –10 °C;
- upper category temperature: +70 °C, +85 °C, +100 °C, +105 °C, +110 °C and +125 °C;
- duration of the damp heat, steady-state test: 4 d, 10 d, 21 d and 56 d.

The severities for the cold and dry heat tests are the lower and upper category temperatures, respectively.

If specified in the detail specification, the humidity robustness grade according to Annex A should be given in connection with the climatic category.

### 2.2 Preferred values of ratings

#### 2.2.1 Nominal capacitance ( $C_N$ ) [IEC 60384-17:2019](https://standards.iteh.ai/catalog/standards/sist/43b422a3-4c0c-4892-a0d6-42400c4e101c/iec-60384-17-2019)

Preferred values of nominal capacitance are values chosen from the E series of IEC 60063, which are given in Table 2, and their decimal multiples ( $\times 10^n$ , where  $n$  is an integer).

#### 2.2.2 Tolerance on nominal capacitance

The preferred tolerances on the nominal capacitance are  $\pm 20\%$ ;  $\pm 10\%$ ;  $\pm 5\%$ ;  $\pm 2\%$ ;  $\pm 1\%$ .

#### 2.2.3 Nominal capacitance with associated tolerance values

For preferred combinations of capacitance series and tolerances, see Table 2.

**Table 2 – Preferred combinations of capacitance series and tolerance**

Preferred combinations	
Series	Tolerances
E 6	$\pm 20\%$
E 12	$\pm 10\%$
E 24	$\pm 5\%$
E 48	$\pm 2\%$
E 96	$\pm 1\%$

#### 2.2.4 Rated AC voltage ( $U_{RAC}$ or $U_{R\sim}$ )

The frequency for the rated AC voltage shall be 50 Hz/60 Hz unless the detail specification prescribes a higher frequency.