



BSI Standards Publication

Fixed capacitors for use in electronic equipment

Part 14: Sectional specification -
Fixed capacitors for electromagnetic
interference suppression and connection to the
supply mains (IEC 60384-14:2013)

National foreword

This British Standard is the UK implementation of EN 60384-14:2013+A1:2016. It is identical to IEC 60384-14:2013, incorporating corrigendum April 2016 and amendment 1:2016. It supersedes BS EN 60384-14:2013 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by A1 A1.

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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31 May 2016	Implementation of IEC corrigendum April 2016: Table 11 and Table 12 modified
30 November 2016	Implementation of IEC amendment 1:2016 with CENELEC endorsement A1:2016

**Fixed capacitors for use in electronic equipment -
Part 14: Sectional specification -
Fixed capacitors for electromagnetic interference suppression and
connection to the supply mains
(IEC 60384-14:2013)**

Condensateurs fixes utilisés dans les
équipements électroniques -
Partie 14: Spécification intermédiaire -
Condensateurs fixes d'antiparasitage et
raccordement à l'alimentation
(CEI 60384-14:2013)

Festkondensatoren zur Verwendung in
Geräten der Elektronik -
Teil 14: Rahmenspezifikation -
Festkondensatoren zur Unterdrückung
elektromagnetischer Störungen, geeignet
für Netzbetrieb
(IEC 60384-14:2013)

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CENELEC

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 40/2199/FDIS, future edition 4 of IEC 60384-14, prepared by IEC/TC 40 "Capacitors and resistors for electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60384-14:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-04-10
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-07-10

This document supersedes EN 60384-14:2005.

EN 60384-14:2013 includes the following significant technical changes with respect to EN 60384-14:2005:

All changes that have been agreed upon can be categorized as minor revisions.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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The text of the International Standard IEC 60384-14:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60335-1	NOTE	Harmonised as EN 60335-1.
IEC 60384-14-3	NOTE	Harmonised as EN 60384-14-3.
IEC 60950-1	NOTE	Harmonised as EN 60950-1.
IEC 61140	NOTE	Harmonised as EN 61140.

Foreword to amendment A1

The text of document 40/2463/FDIS, future IEC 60384-14:2013/A1, prepared by IEC/TC 40 "Capacitors and resistors for electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60384-14:2013/A1:2016.

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national level by publication of an identical national
standard or by endorsement
- latest date by which the national standards conflicting with (dow) 2019-08-18
the document have to be withdrawn

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IEC 60939-3:2015	NOTE	Harmonized as EN 60939-3:2015 (not modified).
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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	2010	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	2010
IEC 60063		Preferred number series for resistors and capacitors	-	-
IEC 60065 (mod)	2001	Audio, video and similar electronic apparatus	EN 60065	2002
+ corr. August	2002	- Safety requirements	+ corr. August	2007
+ A1 (mod)	2005		+ A1	2006
+ A2 (mod)	2010		+ A2	2010
-	-		+ A11	
-	-		+ A12	
IEC 60068-1	1988	Environmental testing -	EN 60068-1 ¹⁾	1994
+ corr. October	1988	Part 1: General and guidance		
IEC 60068-2-17		Environmental testing - Part 2: Tests - Test Q: Sealing	EN 60068-2-17	
IEC 60384-1	2008	Fixed capacitors for use in electronic equipment -	EN 60384-1	2009
+ corr. November	2008	Part 1: Generic specification		
IEC 60417	Data base	Graphical symbols for use on equipment	HD 243 S12 ^{2) 3)}	
IEC 60664-1		Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1 ^{4) 5)}	
IEC 60695-11-10		Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	
IEC 60940		Guidance information on the application of capacitors, resistors, inductors and complete filter units for radio interference suppression	-	-
IEC 61193-2		Quality assessment systems - Part 2: Selection and use of sampling plans for inspection of electronic components and packages	EN 61193-2	

¹⁾ EN 60068-1 includes A1 to IEC 60068-1
+ corr. October.

²⁾ HD 243 S12 includes supplement(s) M to K to IEC 60417.

³⁾ HD 243 S12 is superseded by EN 60417-2:1999, which is based on IEC 60417-2:1998.

⁴⁾ EN 60664-1 includes A1 + A2 to IEC 60664-1.

⁵⁾ EN 60664-1 is superseded by EN 60664-1:2007, which is based on IEC 60664-1:2007.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61210 (mod)		Connecting devices - Flat quick-connect terminations for electrical copper conductors - Safety requirements	EN 61210	
CISPR 17		Methods of measurement of the suppression characteristics of passive EMC filtering devices	EN 55017	
ISO 7000		Graphical symbols for use on equipment - Registered symbols	-	-

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FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains

1 General

1.1 Scope

This part of IEC 60384 applies to capacitors and resistor-capacitor combinations which will be connected to an a.c. mains or other supply with nominal voltage not exceeding 1 000 V a.c. (r.m.s.) or $\sqrt{A_1}$ 1 500 V d.c. $\sqrt{A_1}$ and with a nominal frequency not exceeding 100 Hz.

1.2 Object

The principal object of this part of IEC 60384 is to prescribe preferred ratings and characteristics and to select from IEC 60384-1, 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 will be of equal or higher performance level; lower performance levels are not permitted.

This standard also provides a schedule of safety tests to be used by national testing stations in countries where approval by such stations is required.

The overvoltage categories in combination with the a.c. mains voltages for the capacitors classified in this standard should be taken from IEC 60664-1.

1.3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60063, *Preferred number series for resistors and capacitors*

IEC 60065:2001, *Audio, video and similar electronic apparatus – Safety requirements*
Amendment 1:2005
Amendment 2:2010

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-17, *Environmental testing – Part 2-17: Tests – Test Q: Sealing*

IEC 60384-1:2008, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 60417, *Graphical symbols for use on equipment*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60940, *Guidance information on the application of capacitors, resistors, inductors and complete filter units for radio interference suppression*

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

IEC 61210, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

CISPR 17, *Methods of measurement of the suppression characteristics of passive EMC filtering devices*

ISO 7000, *Graphical symbols for use on equipment – Index and synopsis*

1.4 Information to be given in a detail specification

Detail specifications shall be derived from the relevant 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 following information shall be given in each detail specification and the values quoted shall preferably be selected from the appropriate clause of this sectional specification.

A₁ Requirements for safety approved a.c. capacitors to be used in d.c. applications are found in Annex H. **A₁**

NOTE The information given in 1.4.1 may, for convenience, be presented in tabular form.

1.4.1 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.

Normally, the numerical values shall be given for the length, width and height of the body and the wire spacing, or for cylindrical types, the body diameter and the length and diameter of the terminations. When necessary, for example when a number of capacitance values/voltage ranges are covered by a detail specification, their dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than that 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.

1.4.2 Mounting

The detail specification shall specify the method of mounting to be applied for normal use and for the application of the vibration, 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, bump or shock tests.

If recommendations for mounting for "normal" use are made, they should be included in the detail specification under "1.8 Additional information (Not for inspection purposes)". If recommendations are included, a warning can be given that the full vibration, bump and shock performance may not be available if mounting methods other than those specified in 1.1 of the detail specification are used.

1.4.3 Ratings and characteristics

The ratings and characteristics shall be in accordance with the relevant clauses of this specification, together with the following.

1.4.3.1 Nominal capacitance range

The preferred range of capacitance values should follow 2.2.1 of this standard.

When products approved to the detail specification have different ranges, the following statement should be added: "The range of values available in each voltage range is given in the register of approvals, available for example on the website www.iecq.org".

1.4.3.2 Nominal resistance range (if applicable)

The preferred range of resistance values should follow 2.2.4 of this standard

1.4.3.3 Particular characteristics

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

1.4.4 Marking

The detail specification shall specify the content of the marking on the capacitor and on the package. See also 1.6 of this standard.

1.5 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60384-1, as well as the following, apply.

NOTE Some definitions of IEC 60384-1 have been expanded, as is indicated by a note.

1.5.1

a.c. capacitor

capacitor designed essentially for application with a power-frequency alternating voltage

Note 1 to entry: a.c. capacitors may be used on d.c. supplies having the same voltage as the a.c. r.m.s. rated voltage of the capacitor.

1.5.2

electromagnetic interference suppression capacitor

radio interference suppression capacitor

a.c. capacitor used for the reduction of electromagnetic interference caused by electrical or electronic apparatus, or other sources

1.5.3

capacitor of Class X

RC unit of Class X

capacitor or RC unit of a type suitable for use in situations where failure of the capacitor or RC unit would not lead to danger of electrical shock but could result in a risk of fire

1.5.4

capacitor of Class Y

RC unit of Class Y

capacitor or RC unit of a type suitable for use in situations where failure of the capacitor could lead to danger of electric shock

1.5.5

two-terminal capacitor

electromagnetic interference suppression capacitor having two terminals

SEE: Figure 1.

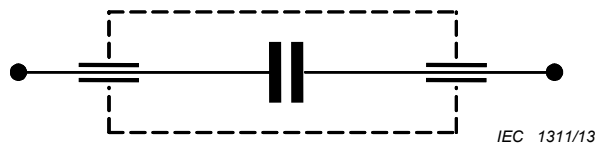


Figure 1 – Two-terminal EMI suppression capacitor

1.5.6

series RC unit

functional combination of a resistor in series with a capacitor of Class X or Y

SEE: Figure 2.

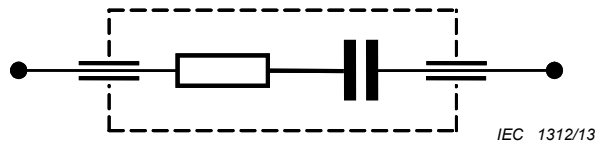


Figure 2 – RC unit

Note 1 to entry: In this standard, where the word "capacitor" appears, the words "capacitor or RC unit" should be understood where the context permits.

1.5.7

lead-through capacitor, <coaxial>

capacitor with a central current-carrying conductor surrounded by a capacitor element which is symmetrically bonded to the central conductor and to the outer casing to form a coaxial construction; it is coaxially mounted

SEE: Figure 3.

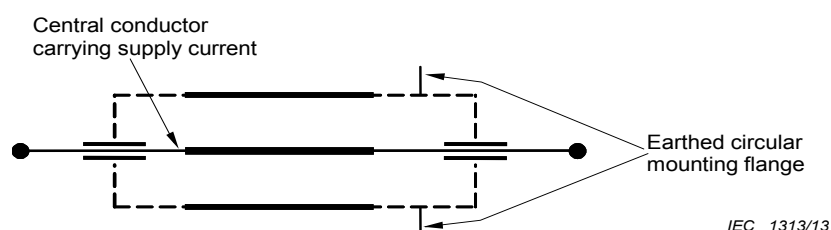


Figure 3 – Lead-through capacitor (coaxial)

1.5.8

lead-through capacitor, <non-coaxial>

capacitor in which the supply currents flow through or across the electrodes

SEE: Figures 4a, 4b, 4c and 4d.

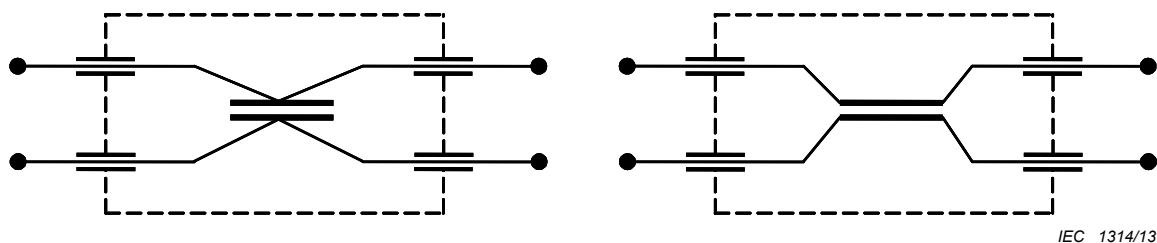


Figure 4a – Lead-through capacitor for symmetrical use (non-coaxial)

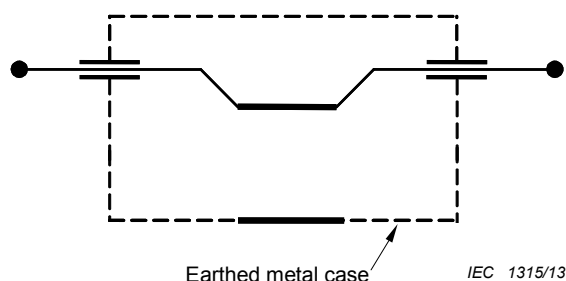


Figure 4b – Lead-through capacitor for asymmetrical use (non-coaxial)

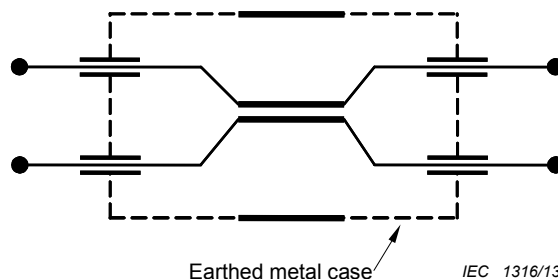


Figure 4c – Multiple unit lead-through capacitor (non-coaxial)
for symmetrical and asymmetrical use

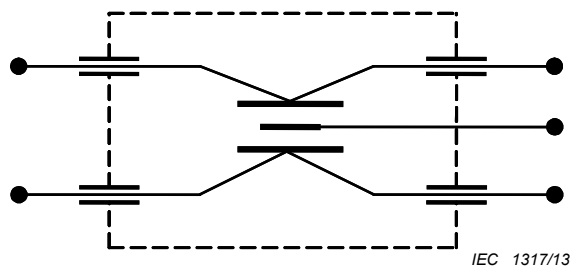


Figure 4d – Multiple unit lead-through capacitor

Figure 4 – Lead-through capacitors

1.5.9

by-pass capacitor

capacitor where radiofrequency interference currents are by-passed

Note 1 to entry: There are three common forms: single, delta and T-connected. The single capacitor consists of a capacitor in a metal case with one termination connected to the case as in Figure 5a; the delta form consists of an X-capacitor and two Y2-capacitors arranged in a delta network as in Figure 5b; the T-connected form consists of three capacitors C_A , C_B and C_C connected in T as shown in Figure 5c.

The delta and T-connected forms are electrically equivalent (star-delta transformation). In the T-connected form the X-capacitor is the result of the series connection of $C_B - C_C$ and the Y-capacitors are the results of the series connections of $C_A - C_B$ and $C_A - C_C$.

When T-connected capacitors are submitted to tests, and it is stated that voltages shall be applied across the X-capacitors, such voltages shall be applied between the line and neutral terminations. Similarly, when it is stated that voltages shall be applied across the Y-capacitors, such voltages shall be applied between the line and neutral terminations connected together and the earth termination.

SEE: Figures 5a, 5b and 5c.

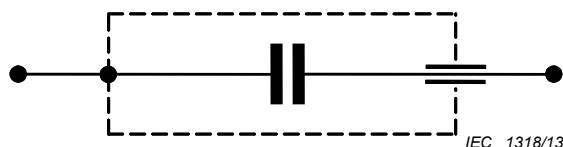


Figure 5a – Single by-pass capacitor

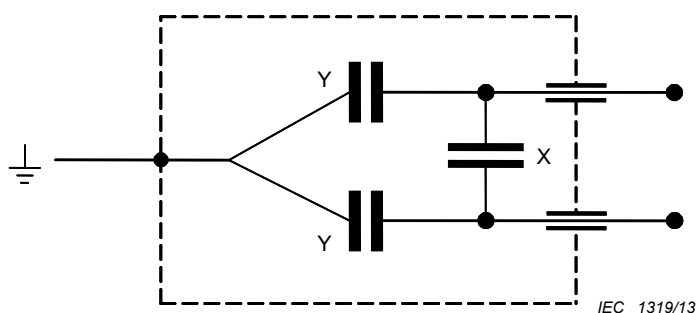


Figure 5b – Delta by-pass capacitor (in metallic housing)

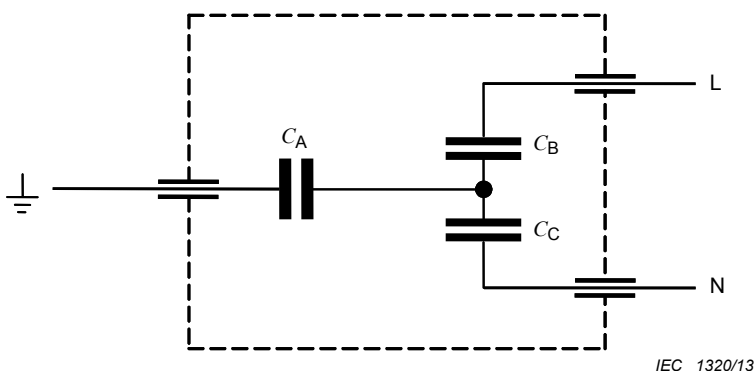


Figure 5c – Example of a T-connected by-pass capacitor (in non-metallic housing)

NOTE For capacitors with non-metallic housings, the earth connection is brought out as a separate termination as is shown in Figure 5c.

Figure 5 – By-pass capacitors

1.5.10

rated voltage

either the r.m.s. operating voltage of rated frequency, or the d.c. operating voltage, which may be applied continuously to the terminations of a capacitor at any temperature between the lower and the upper category temperatures

Note 1 to entry: This implies, for capacitors covered by this standard, that the category voltage is the same as the rated voltage.

1.5.11

rated power, <of a series RC unit>

maximum power which can be dissipated by the RC unit at the rated temperature during continuous operation

1.5.12

upper category temperature

maximum surface temperature for which the capacitor has been designed to operate continuously

Note 1 to entry: For lead-through capacitors and series RC units, the external surface temperature can be affected by internal heating due to the lead-through current. The terminations of a capacitor are considered to be part of the external surface.

Note 2 to entry: This definition replaces that given in IEC 60384-1:2008, 2.2.41, because suppression capacitors in accordance with this standard are intended to be connected to the mains network and may have internal heat generation as a result.

1.5.13

lower category temperature

minimum surface temperature for which the capacitor has been designed to operate continuously

Note 1 to entry: This definition replaces that given in IEC 60384-1:2008, 2.2.10.

1.5.14

rated temperature, <of a lead-through capacitor or series RC unit>

maximum ambient temperature at which a lead-through capacitor can carry its rated lead-through current or a series RC unit can dissipate its rated power

Note 1 to entry: This definition replaces that in IEC 60384-1:2008, 2.2.24.

1.5.15

insertion loss

ratio of the voltage before and after the insertion of the suppressor as measured at the terminations

Note 1 to entry: When measured in decibels, the insertion loss is 20 times the logarithm to base 10 of the ratio stated.

1.5.16

rated current of the conductors, <lead-through capacitor>

maximum permissible current flowing through the conductors of the capacitor at the rated temperature during continuous operation

1.5.17

main resonant frequency, <two-terminal capacitor>

lowest frequency at which the impedance of the capacitor is a minimum when applying a sinusoidal voltage

1.5.18

impulse voltage

periodic transient voltage of a defined waveform as described in IEC 60060-1

1.5.19

passive flammability

ability of a capacitor to burn with a flame as a consequence of the application of an external source of heat

1.5.20

active flammability

ability of a capacitor to burn with a flame as a consequence of electric loading

1.6 Marking

See IEC 60384-1:2008, 2.4 with the following details.

The 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) manufacturer's name or trademark;
- b) manufacturer's type designation or the type designation given in the detail specification;
- c) capacitor class and subclass;
- d) recognized approval mark;
- e) nominal capacitance(s) and nominal resistance;
- f) rated voltage and nature of supply (alternating voltage may be indicated by the symbol  (IEC 60417-5032:2002) and direct voltage by the symbol  (IEC 60417-5031:2002) or , also a.c. and d.c. respectively for alternating voltage and direct voltage can be used;
- g) the method of connection, if necessary;
- h) rated current of the conductor (in the case of a lead-through capacitor);
- i) tolerance on rated capacitance if different from $\pm 20\%$;
- j) climatic category, followed by a letter indicating passive flammability category;
- k) rated temperature;
- l) year and month (or week) of manufacture;
- m) reference to the detail specification.

1.6.1 Marking of capacitors

The capacitor shall be clearly marked with a), b) and c) and also d), e) and f) if these are not implied by b), and as many of the remaining items as are considered necessary by the manufacturer. The marking shall be sufficient to enable a clear identification of the component to be made.

NOTE For surface mount components, see Annex F.

It is recommended that a caution mark be printed on the printed circuit board where a safety component is mounted. The caution mark shall be ISO 7000-0434:2004. The mark is in the form of an upright equilateral triangle containing an exclamation mark.

This caution mark is referred to in IEC 60065:2001, 5.3. Any duplication of information in the marking on the capacitor should be avoided.

1.6.2 Marking of packaging

The package containing the capacitor(s) shall be clearly marked with all the information listed above. National approvals may be indicated by lettering as an alternative to the approval mark.

1.6.3 Additional marking

Any additional marking shall be applied in such a way that no confusion can arise.

1.7 Classification of Class X and Class Y capacitors

1.7.1 Classification of X capacitors

Class X capacitors are divided into two subclasses (see Table 1) according to the peak voltage of the impulses superimposed on the mains voltage to which they may be subjected in service. Such impulses may arise from lightning strikes on outside lines, from switching in neighbouring equipment, or switching in the equipment in which the capacitor is used.

Table 1 – Classification of Class X capacitors

Subclass	Peak impulse voltage in service	Application	Peak impulse voltage U_P applied before endurance test
X1	>2,5 kV ≤4,0 kV	High pulse application	When $C_N \leq 1,0 \mu\text{F}$ $U_P = 4 \text{ kV}$ When $C_N > 1,0 \mu\text{F}$ $U_P = \frac{4}{\sqrt{\frac{C_N}{10^{-6} \text{ F}}}}$ in kV
X2	≤2,5 kV	General purpose	When $C_N \leq 1,0 \mu\text{F}$ $U_P = 2,5 \text{ kV}$ When $C_N > 1,0 \mu\text{F}$ $U_P = \frac{2,5}{\sqrt{\frac{C_N}{10^{-6} \text{ F}}}}$ in kV
X1 capacitors may be substituted by Y2 or Y1 capacitors of the same or higher U_R . X2 capacitors can be substituted with X1 or Y2 or Y1 capacitors of the same or higher U_R .			
NOTE 1 The factor used for the reduction of U_P for capacitance values above $1,0 \mu\text{F}$ maintains $0,5 \times C_N U_P^2$ constant for these capacitance values; C_N is in F.			
NOTE 2 Overvoltage categories in association with rated impulse voltage and rated mains voltage are found in IEC 60664-1.			

1.7.2 Classification of Y capacitors

Class Y capacitors are further divided into three subclasses, Y1, Y2 and Y4, as shown in Table 2.

Table 2 – Classification of Class Y capacitors

Subclass	Type of insulation bridged	Range of rated voltages	Peak impulse voltage U_P applied before endurance test
Y1	Double insulation or reinforced insulation	≤ 500 V	$U_P = 8,0$ kV
Y2	Basic insulation or supplementary insulation	≥ 150 V ≤ 500 V	When $C_N \leq 1,0$ μ F $U_P = 5$ kV When $C_N > 1,0$ μ F $U_P = \frac{5}{\sqrt{\frac{C_N}{10^{-6} \text{ F}}}} \text{ kV}$
Y4	Basic insulation or supplementary insulation	< 150 V	$U_P = 2,5$ kV
Y2 capacitors may be substituted by Y1 capacitors of the same or higher U_R .			
NOTE 1 For definitions of basic, supplementary, double and reinforced insulation, see IEC 61140.			
NOTE 2 The factor used for the reduction of U_P for capacitance values above $1,0$ μ F maintains $0,5 \times C_N U_P^2$ constant for these capacitance values; C_N is in F.			
NOTE 3 Overvoltage categories in association with rated impulse voltage and rated mains voltage are found in IEC 60664-1.			

The enclosure of a Y1-capacitor shall not contain other components.

Assemblies, like Delta by-pass or T-connected by-pass capacitors, may be constructed from Y-capacitors and X-capacitors provided these capacitors fulfil the requirements for the relevant X and Y subclasses.

One Y-capacitor may bridge basic insulation. One Y-capacitor may bridge supplementary insulation. If combined basic and supplementary insulations are bridged by two or more Y2- or Y4-capacitors in series, they shall have the same class and sub-class, the same rated voltage and the same nominal capacitance value.

2 Preferred ratings and characteristics

2.1 Preferred characteristics

The values given in detail specifications shall preferably be selected from the following.

2.1.1 Preferred climatic categories

The capacitors covered by this standard are classified into climatic categories according to the general rules given in IEC 60068-1:1988, Annex A.

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

- lower category temperature: -65 °C, -55 °C, -40 °C, -25 °C and -10 °C;
- upper category temperature: $+85$ °C, $+100$ °C, $+105$ °C, $+125$ °C and $+155$ °C;
- duration of the damp heat, steady state test: 21 and 56 days.

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

For guidance on the application of the categories described above, see IEC 60940.

2.2 Preferred values of ratings

2.2.1 Nominal capacitance (C_N)

The preferred values of nominal capacitance are:

1, 1,5, 2,2, 3,3, 4,7, 6,8 and their decimal multiples.

These values conform to the E6 series of preferred values given in IEC 60063.

2.2.2 Tolerance on nominal capacitance

The maximum tolerance on nominal capacitance is $\pm 20\%$.

2.2.3 Rated voltage (U_R)

The preferred values of rated voltage are 125 V, 250 V, 275 V, 400 V, 440 V, 500 V, 760 V and 1 000 V.

Electromagnetic interference suppression capacitors should be chosen to have a rated voltage equal to, or greater than, the nominal voltage of the supply system to which they are connected. The design of the capacitors should take into account the possibility that the voltage of the system may rise by up to 10 % above its nominal voltage. In star connections the maximum voltage over the capacitors shall be calculated in the worst possible case when the nominal capacitance tolerances of the capacitors used are considered.

2.2.4 Nominal resistance (R_N)

Preferred values of nominal resistance shall be taken from the E6 series of IEC 60063.

2.2.5 Rated temperature

The rated temperature for lead-through capacitors and series RC units shall be not less than +40 °C.

2.2.6 Passive flammability

The preferred category of passive flammability permitted is Category B (see 4.17). If category C is used, it has to be agreed between the component supplier and the customer. See 4.17 also for alternative passive flammability testing.

Exemption: For components smaller than 1 750 mm³ passive flammability category C is permitted.

Passive flammability categories better than C may require flame retardant additives which may be considered to cause environmental impact. These categories should be subject to discussion between manufacturers and customers to find a compromise between safety and environmental requirements.

2.3 Requirements for sleeving, tape, tubing and wire insulation

Sleeving, tape, tubing and wire insulation used in the components falling under this standard shall be rated for the voltage involved and the temperature attained under any condition of actual use. They shall be flame retardant according to Class VW1.

If insulated terminals are requested, the preferable colours should be transparent or white.

3 Assessment procedures

3.1 Primary stage of manufacture

For wound capacitors, the primary stage of manufacture is the winding of the capacitor element. For single-layer ceramic capacitors, it is the metallization of the dielectric to form the electrodes. For fixed multilayer ceramic capacitors, it is the first common firing of the dielectric-electrode assembly. For other types of capacitor, it shall be the same as that given in the sectional specification for the dielectric used.

3.2 Structurally similar components

Capacitors considered as being structurally similar are capacitors produced with essentially the same processes and materials, though they may be of different case sizes and capacitance values, but of the same class and rated voltage.

3.3 Certified records of released lots

The information required in IEC 60384-1:2008, Clause Q.9, shall be made available when prescribed in the detail specification and when requested by a customer. After the endurance test the parameters for which variables information is required are capacitance change, resistance change (for RC units), $\tan \delta$ and insulation resistance.

3.4 Approval testing

3.4.1 Safety tests only approval

Tables 3 and 6 form a schedule limited to tests concerning safety only requirements. The schedule to be used for safety tests only approval will be on the basis of fixed sample sizes as given in 3.4.3 and Table 3 of this standard. Prior to the approval testing being carried out, it is necessary to submit to the certification body a declaration of design (see Annex D) registering essential data and basic design details of the capacitors for which approval is sought.

3.4.2 Qualification approval

Tables 4, 5 and 7 shall be used when qualification approval is sought.

The procedures for qualification approval testing are given in the generic specification, IEC 60384-1:2008, Clause Q.5, in which Q.5.3a) refers to lot-by-lot and periodic inspections. The schedules to be used for qualification approval testing on the basis of lot-by-lot and periodic inspections are given in 3.5 and Table 8 of this standard. The schedule to be used for qualification approval testing on the basis of fixed sample sizes according to IEC 60384-1:2008, Q.5.3b), is given in 3.4.3 and Tables 4 and 5 of this standard. For the two procedures, the sample sizes and the number of permissible nonconforming items shall be of comparable order. The test conditions and requirements shall be the same. Qualification approval according to the fixed sample sizes of Tables 4 and 5 is preferred.

3.4.3 Qualification approval on the basis of the fixed sample size procedure

3.4.3.1 Sampling

Capacitors of each technology, rated voltage, class and subclass shall be separately qualified. The total number of capacitors of each rated voltage in each group is given in Tables 3, 4 and 5. For multi-section capacitors containing sections of different classes and for lead-through capacitors, larger numbers are required as indicated.

The sample shall contain equal numbers of specimens of the highest and lowest capacitance values in the range to be qualified, except for the passive flammability test of 4.17 and the active flammability test of 4.18. For the passive flammability test, the rules of sampling