

INTERNATIONAL STANDARD

IEC 60384-14

QC 302400

Third edition
2005-07

**Fixed capacitors for use in
electronic equipment –**

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

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IEC 60384-14:2005

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

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

FOREWORD

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International Standard IEC 60384-14 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 1993 and amendment 1 (1995). It constitutes a technical revision. All changes that have been agreed upon can be categorized as minor revisions.

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

FDIS	Report on voting
40/1552/FDIS	40/1586/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 60384 consists of the following parts, under the general title *Fixed capacitors for use in electronic equipment*:

- Part 1: Generic specification
- Part 2: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric d.c. capacitors
- Part 3: Sectional specification: Fixed tantalum chip capacitors
- Part 4: Sectional specification: Aluminium electrolytic capacitors with solid and non-solid electrolyte
- Part 5: Sectional specification: Fixed mica dielectric d.c. capacitors with a rated voltage not exceeding 3 000 V - Selection of methods of test and general requirements
- Part 6: Sectional specification: Fixed metallized polycarbonate film dielectric d.c. capacitors
- Part 7: Sectional specification: Fixed polystyrene film dielectric metal foil d.c. capacitors
- Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1
- Part 9: Sectional specification: Fixed capacitors of ceramic dielectric, Class 2
- Part 11: Blank detail specification: Fixed polyethylene-terephthalate film dielectric metal foil d.c. capacitors – Assessment level E
- Part 12: Sectional specification: Fixed polycarbonate film dielectric metal foil d.c. capacitors
- Part 13: Sectional specification: Fixed polypropylene film dielectric metal foil d.c. capacitors
- Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains
- Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte
- Part 16: Sectional specification: Fixed metallized polypropylene film dielectric d.c. capacitors
- Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors
- Part 18: Sectional specification: Fixed aluminium electrolytic chip capacitors with solid and non-solid electrolyte
- Part 19: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric chip d.c. capacitors
- Part 20: Sectional specification: Fixed metallized polyphenylene sulfide film dielectric chip d.c. capacitors
- Part 21: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1
- Part 22: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

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 standard may be issued at a later date.

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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 1 000 V d.c. and with a nominal frequency not exceeding 100 Hz.

1.2 Object

The principal object of this standard 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 shall be of equal or higher performance level, lower performance levels not being permitted.

A further object of this standard is to provide a schedule of safety tests to be used by national testing stations in countries where approval by such stations is required.

1.3 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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

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

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

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

IEC 60335-1, *Household and similar electrical appliances – Safety – Part 1: General requirements*

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

IEC 60384-14-4, *Fixed capacitors for use in electronic equipment – Part 14: Blank detail specification: Fixed capacitors for electromagnetic interference supply and connection to the supply mains – Assessment level D*

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

IEC 60760, *Flat, quick-connect terminations*

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

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

CISPR 17, *Methods of measurement of the suppression characteristics of passive radio interference filters and suppression components*

IEC QC 001005, *IEC Quality Assessment System for Electronic Components (IECQ) – Register of Firms, Products and Services approved under the IECQ System, including ISO 9000*

ISO 7000-DB¹, *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.

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.

¹ DB refers to the ISO on-line database.

NOTE 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 Rated capacitance range

See 2.2.1.

NOTE 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 IEC QC 001005."

1.4.3.2 Rated resistance range (if applicable)

See 2.2.4.

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 specification.

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, and this is indicated by reference to this note.

1.5.1

a.c. capacitor

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

NOTE AC 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)

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

1.5.3

capacitor or 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

Class X capacitors are divided into three 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	IEC 60664-1 installation category	Application	Peak impulse voltage U_p applied before endurance test
X1	> 2,5 kV ≤ 4,0 kV	III	High pulse application	When $C_R \leq 1,0 \mu\text{F}$ $U_p = 4 \text{ kV}$ When $C_R > 1,0 \mu\text{F}$ $U_p = \frac{4}{\sqrt{\frac{C_R}{10^{-6} \text{ F}}}} \text{ kV}$
X2	≤ 2,5 kV	II	General purpose	When $C_R \leq 1,0 \mu\text{F}$ $U_p = 2,5 \text{ kV}$ When $C_R > 1,0 \mu\text{F}$ $U_p = \frac{2,5}{\sqrt{\frac{C_R}{10^{-6} \text{ F}}}} \text{ kV}$
X3	≤ 1,2 kV	-	General purpose	None

NOTE The factor used for the reduction of U_p for capacitance values above $1,0 \mu\text{F}$ maintains $\frac{1}{2} \times C_R U_p^2$ constant for these capacitance values; C_R is in F.

1.5.4

capacitor or 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

Class Y capacitors are further divided into four subclasses, Y1, Y2, Y3 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 before endurance test
Y1	Double insulation or reinforced insulation	≤ 500 V	8,0 kV
Y2	Basic insulation or supplementary insulation	≥ 150 V ≤ 300 V	5,0 kV
Y3	Basic insulation or supplementary insulation	≥ 150 V ≤ 250 V	None
Y4	Basic insulation or supplementary insulation	< 150 V	2,5 kV

NOTE 1 For definitions of basic, supplementary, double and reinforced insulation, see IEC 61140.
NOTE 2 Y2 capacitors may be substituted by Y1 capacitors of the same or higher U_R .

The enclosure of a Y1-capacitor shall not contain other components. Assemblies 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 Y2-, Y3- or Y4-capacitors in series, they shall have the same nominal value.

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

1.5.5**two-terminal capacitor**

electromagnetic interference suppression capacitor having two terminals (see Figure 1)

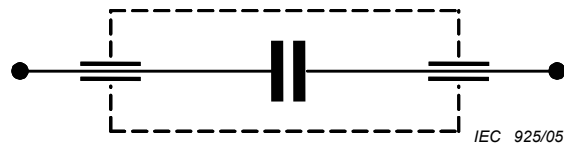


Figure 1 – Two-terminal capacitor

1.5.6**series RC unit**

functional combination of a resistor in series with a capacitor of Class X or Y (see Figure 2)

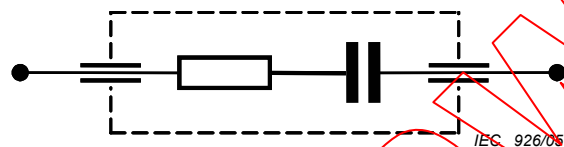


Figure 2 – RC unit

NOTE 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 should be mounted coaxially (see Figure 3)

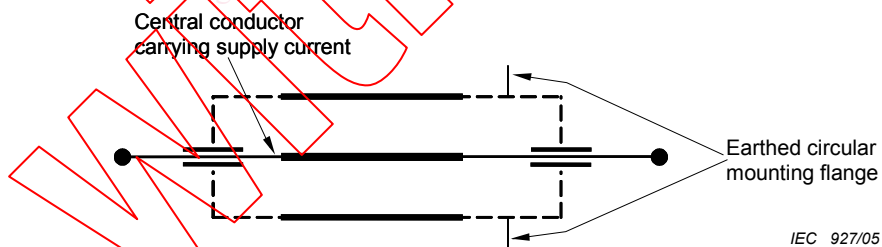


Figure 3 – Lead-through capacitor (coaxial)

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)

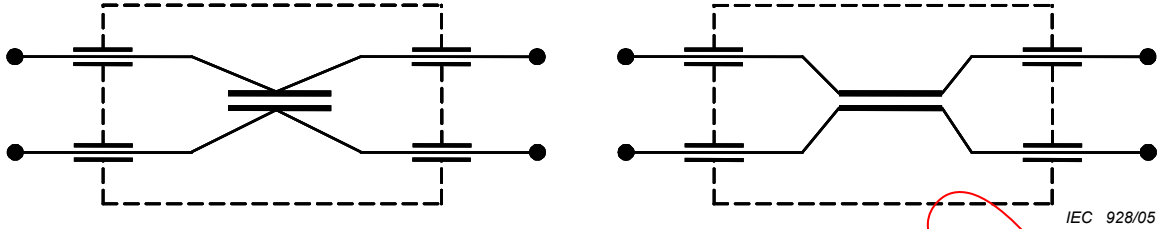


Figure 4a – Lead-through capacitor for symmetrical use (non-coaxial)

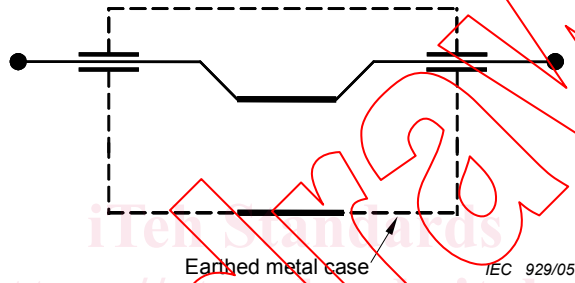


Figure 4b – Lead-through capacitor for asymmetrical use (non-coaxial)

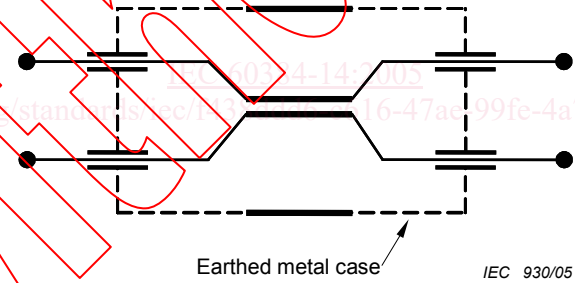


Figure 4c – Multiple unit lead-through capacitor (non-coaxial) for symmetrical and asymmetrical use

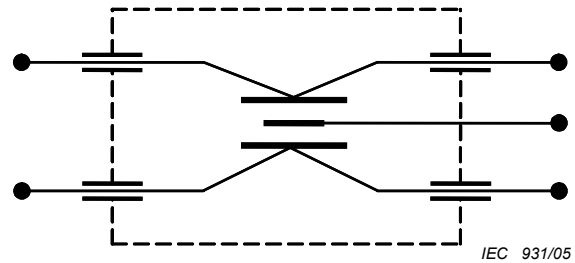


Figure 4d – Multiple unit lead-through capacitor

Figure 4 – Lead-through capacitors