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(IEC 60384-14 : 2005)

(JEITA)

**Fixed capacitors for use in
electronic equipment—
Part 14: Sectional specification:
Fixed capacitors for electromagnetic
interference suppression and
connection to the supply mains**

ICS 31.060.10

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Contents

	Page
Introduction.....	1
1 General	1
1.1 Scope	1
1.2 Object	1
1.3 Normative references	2
1.4 Information to be given in a detail specification	3
1.5 Terms and definitions	5
1.6 Marking	11
2 Preferred ratings and characteristics	12
2.1 Preferred characteristics	12
2.2 Preferred values of ratings	12
3 Assessment procedures	13
3.1 Primary stage of manufacture	13
3.2 Structurally similar components	13
3.3 Certified records of released lots	13
3.4 Approval testing	13
3.5 Quality conformance inspection	25
4 Test and measurement procedures	28
4.1 Visual examination and check of dimensions	28
4.2 Electrical tests	29
4.3 Robustness of terminations	32
4.4 Resistance to soldering heat	33
4.5 Solderability	33
4.6 Rapid change of temperature	34
4.7 Vibration	34
4.8 Bump	34
4.9 Shock	35
4.10 Container sealing.....	35
4.11 Climatic sequence	36
4.12 Damp heat, steady state	37
4.13 Impulse voltage	38
4.14 Endurance	39
4.15 Charge and discharge	42
4.16 Radiofrequency characteristics	43
4.17 Passive flammability test	43
4.18 Active flammability test	44
4.19 Component solvent resistance (if applicable)	46

4.20 Solvent resistance of the making	46
Annex A (normative) Circuit for the impulse voltage test	47
Annex B (normative) Circuit for the endurance test	49
Annex C (normative) Circuit for the charge and discharge test	50
Annex D (normative) Declaration of design (confidential to the manufacturer and the certification body)	51
Annex E (informative) Pulse test circuit	52
Annex F (normative) Particular requirements for safety test of surface- mounting capacitors	54
Annex G (informative) Capacitance ageing of fixed capacitors of ceramic dielectric, Class 2	57

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Electronics and Information Technology Industries Association (JEITA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 5101-14:1998** is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS C 5101 consists of the following 43 parts under the general title “*Fixed capacitors for use in electronic equipment*”:

JIS C 5101-1 *Part 1: Generic specification*

JIS C 5101-2 *Part 2: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric d.c. capacitors*

JIS C 5101-2-1 *Part 2-1: Blank detail specification: Fixed metallized polyethylene-terephthalate film dielectric d.c. capacitors—Assessment levels E and EZ*

JIS C 5101-3 *Part 3: Sectional specification: Fixed tantalum chip capacitors*

JIS C 5101-3-1 *Part 3: Blank detail specification: Fixed tantalum chip capacitors Assessment level E*

JIS C 5101-4 *Part 4: Sectional specification: Aluminium electrolytic capacitors with solid and non-solid electrolyte*

JIS C 5101-4-1 *Part 4: Blank detail specification: Aluminium electrolytic capacitors with non-solid electrolyte Assessment level E*

JIS C 5101-4-2 *Part 4: Blank detail specification: Aluminium electrolytic capacitors with solid electrolyte Assessment level E*

JIS C 5101-8 *Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1*

JIS C 5101-8-1 *Part 8-1: Blank detail specification: Fixed capacitors of ceramic dielectric, Class 1 Assessment level EZ*

JIS C 5101-9 *Part 9: Sectional specification: Fixed capacitors of ceramic dielectric, Class 2*

JIS C 5101-9-1 *Part 9-1: Blank detail specification: Fixed capacitors of ceramic dielectric, Class 2 Assessment level EZ*

- JIS C 5101-11 *Part 11: Sectional specification: Fixed polyethylene-terephthalate film dielectric metal foil d.c. capacitors*
- JIS C 5101-11-1 *Part 11: Blank detail specification: Fixed polyethylene-terephthalate film dielectric metal foil d.c. capacitors Assessment level E*
- JIS C 5101-13 *Part 13: Sectional specification—Fixed polypropylene film dielectric metal foil d.c. capacitors*
- JIS C 5101-13-1 *Part 13-1: Blank detail specification: Fixed polypropylene film dielectric metal foil d.c. capacitors—Assessment levels E and EZ*
- JIS C 5101-14 *Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*
- JIS C 5101-14-1 *Part 14-1: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level D*
- JIS C 5101-14-2 *Part 14-2: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Safety tests only*
- JIS C 5101-14-3 *Part 14-3: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level DZ*
- JIS C 5101-15 *Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte*
- JIS C 5101-15-1 *Part 15: Blank detail specification: Fixed tantalum capacitors with non-solid electrolyte and foil electrode Assessment level E*
- JIS C 5101-15-2 *Part 15: Blank detail specification: Fixed tantalum capacitors with non-solid electrolyte and porous anode Assessment level E*
- JIS C 5101-15-3 *Part 15: Blank detail specification: Fixed tantalum capacitors with solid electrolyte and porous anode Assessment level E*
- JIS C 5101-16 *Part 16: Sectional specification: Fixed metallized polypropylene film dielectric d.c. capacitors*
- JIS C 5101-16-1 *Part 16-1: Blank detail specification: Fixed metallized polypropylene film dielectric d.c. capacitors—Assessment levels E and EZ*
- JIS C 5101-17 *Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors*
- JIS C 5101-17-1 *Part 17-1: Blank detail specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors—Assessment levels E and EZ*
- JIS C 5101-18 *Part 18: Sectional specification: Fixed aluminium electrolytic chip capacitors with solid (MnO₂) and non-solid electrolyte*
- JIS C 5101-18-1 *Part 18: Blank detail specification: Fixed aluminium electrolytic chip capacitors with solid (MnO₂) electrolyte Assessment level E*
- JIS C 5101-18-2 *Part 18: Blank detail specification: Fixed aluminium electrolytic chip capacitors with non-solid electrolyte Assessment level E*

- JIS C 5101-20 *Part 20: Sectional specification: Fixed metallized polyphenylene sulfide film dielectric chip d.c. capacitors*
- JIS C 5101-20-1 *Part 20: Blank detail specification: Fixed metallized polyphenylene sulfide film dielectric chip d.c. capacitors Assessment level EZ*
- JIS C 5101-21 *Part 21: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1*
- JIS C 5101-21-1 *Part 21-1: Blank detail specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1—Assessment level EZ*
- JIS C 5101-22 *Part 22: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2*
- JIS C 5101-22-1 *Part 22-1: Blank detail specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2—Assessment level EZ*
- JIS C 5101-23 *Part 23: Sectional specification—Fixed surface mount metallized polyethylene naphthalate film dielectric DC capacitors*
- JIS C 5101-23-1 *Part 23-1: Blank detail specification—Fixed surface mount metallized polyethylene naphthalate film dielectric DC capacitors—Assessment level EZ*
- JIS C 5101-24 *Part 24: Sectional specification—Surface mount fixed tantalum electrolytic capacitors with conductive polymer solid electrolyte (to be published)*
- JIS C 5101-24-1 *Part 24-1: Blank detail specification—Surface mount fixed tantalum electrolytic capacitors with conductive polymer solid electrolyte—Assessment level EZ (to be published)*
- JIS C 5101-25 *Part 25: Sectional specification—Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte (to be published)*
- JIS C 5101-25-1 *Part 25-1: Blank detail specification—Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte—Assessment level EZ (to be published)*

**Fixed capacitors for use in
electronic equipment—Part 14:
Sectional specification:
Fixed capacitors for electromagnetic
interference suppression and
connection to the supply mains**

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **IEC 60384-14** published in 2005 without modifying the technical contents.

The portions underlined with dots are the matters not stated in the original International Standard.

1 General

1.1 Scope

This Standard is a sectional specification associated with the generic specification **JIS C 5101-1** and specifies fixed capacitors for electromagnetic interference suppression connection to the supply mains. This Standard 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.

NOTE : The International Standard corresponding to this Standard is as follows.

IEC 60384-14:2005 *Fixed capacitors for use in electronic equipment—Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains* (IDT)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

1.2 Object

The principal object of this Standard is to prescribe preferred ratings and characteristics and to select from **JIS C 5101-1**, 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 standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall apply but the revisions (including amendments) made thereafter shall not apply. The normative references without the indication of the year shall apply only to the most recent editions (including amendments).

JIS C 2809:1999 *Flat, quick-connect terminations*

NOTE : Corresponding International Standard: IEC 60760:1989 *Flat, quick-connect termination* and Amendment 1:1993 (MOD)

JIS C 5063:1997 *Preferred number series for resistors and capacitors*

NOTE : Corresponding International Standard: IEC 60063:1963 *Preferred number series for resistors and capacitors*, Amendment 1:1967, and Amendment 2:1977 (IDT)

JIS C 5101-1:1998 *Fixed capacitors for use in electronic equipment Part 1: Generic specification*

NOTE : Corresponding International Standard: IEC 60384-1:1982 *Fixed capacitors for use in electronic equipment—Part 1: Generic specification*, Amendment 2:1987, Amendment 3:1989 and Amendment 4:1992 (MOD)

In addition, **JIS C 5101-1:1998** does not correspond to the latest edition, **IEC 60384-1:1999**, so the numbering system of applicable items may not correspond with each other. In the case of deviating the numbering, the number of **IEC 60384-1:1999** is shown in NOTE.

JIS C 5101-14-1:2009 *Fixed capacitors for use in electronic equipment—Part 14-1: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level D*

NOTE : Corresponding International Standard: IEC 60384-14-1:2005 *Fixed capacitors for use in electronic equipment—Part 14-1: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level D* (IDT)

JIS C 5101-14-3 *Fixed capacitors for use in electronic equipment—Part 14-3: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level DZ*

NOTE : Corresponding International Standard: IEC 60384-14-3:2004 *Fixed capacitors for use in electronic equipment—Part 14-3: Blank detail specification—Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level DZ* (IDT)

JIS C 60068-1:1993 *Environmental testing Part 1: General and guidance*

NOTE : Corresponding International Standard: IEC 60068-1:1988 *Environmental testing—Part 1: General and guidance* and Amendment 1:1992 (IDT)

JIS C 60068-2-17:2001 *Basic environmental testing procedures—Part 2: Tests—Test Q: Sealing*

NOTE : Corresponding International Standard: IEC 60068-2-17:1994 *Basic environmental testing procedures—Part 2: Tests—Test Q: Sealing* (IDT)

JIS Z 9015-1 *Sampling procedures for inspection by attributes—Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

NOTE : Corresponding International Standard: IEC 60410:1973 *Sampling plans and procedures for inspection by attributes* (MOD)

IEC 60060-1:1989 *High-voltage test techniques. Part 1: General definitions and test requirements*

IEC 60335-1:2004 *Household and similar electrical appliances—Safety—Part 1: General requirements*

IEC 60664-1:2002 *Insulation coordination for equipment within low-voltage systems—Part 1: Principles, requirements and tests*

IEC 60940:1988 *Guidance information on the application of capacitors, resistors, inductors and complete filter units for radio interference suppression*

IEC 61140:2001 *Protection against electric shock—Common aspects for installation and equipment* and Amendment 1:2004

CISPR 17:1981 *Methods of measurement of the suppression characteristics of passive radio interference filters and suppression components*

ISO 7000-DB:2004 *Graphical symbols for use on equipment—Index and synopsis*

NOTE : DB refers to the **ISO** on-line database.

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 bank 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 Standard.

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.

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 Standard, together with the following.

1.4.3.1 Rated capacitance range

See **2.2.1** for rated capacitance range.

NOTE : In the case of International Electrotechnical Commission Quality Assessment System for Electronic Components (IECQ), 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 qualified products list (QPL).”

1.4.3.2 Rated resistance range (if applicable)

See **2.2.4** for rated resistance range.

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.

1.5 Terms and definitions

For the purposes of this document, the terms and definitions of **JIS C 5101-1**, as well as the following, apply.

NOTE : Some definitions of **JIS C 5101-1** 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 insulation category	Application	Peak impulse voltage U_P applied before endurance test
X1	$> 2.5 \text{ kV}$ $\leq 4 \text{ kV}$	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	$\leq 2.5 \text{ kV}$	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	$\leq 1.2 \text{ kV}$	—	General purpose	None
NOTE : The factor used for the reduction of U_P for capacitance values above $1 \mu\text{F}$ maintains $1/2 \times C_R U_P^2$ 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 fulfill 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 1 If insulated terminals are requested, the preferable colours should be transparent or white.

NOTE 2 The bridge means that a state where the conductive parts on both sides of an insulation are connected across terminations of a capacitor.

1.5.5 two-terminal capacitor

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

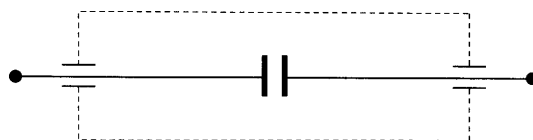


Figure 1 Two-terminal capacitor

1.5.6 series RC unit

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

NOTE : In this Standard, where the word “capacitor” appears, the words “capacitor or RC unit” should be understood where the context permits.

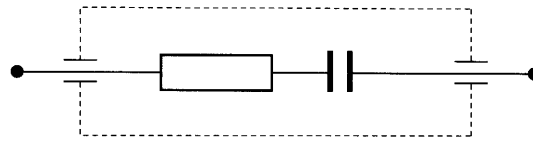


Figure 2 RC unit

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).

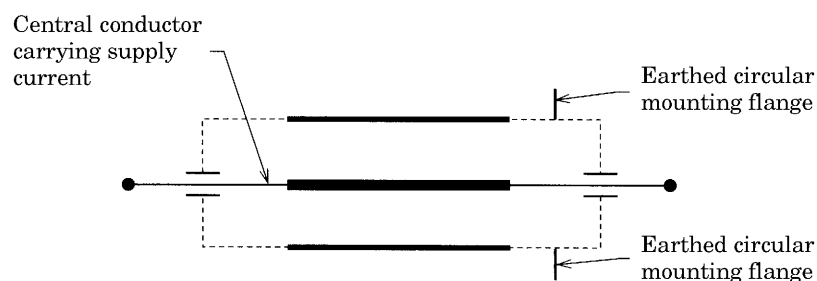


Figure 3 Lead-through capacitor (coaxial)

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)

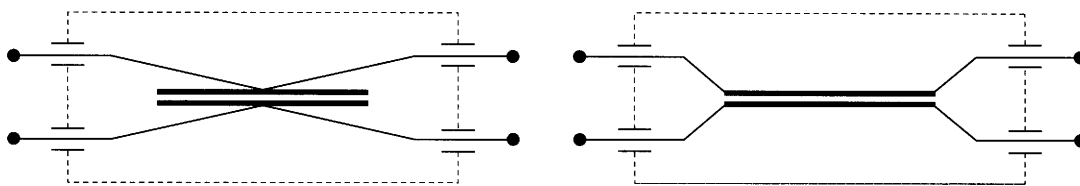


Figure 4a Lead-through capacitor for symmetrical use (non-coaxial)

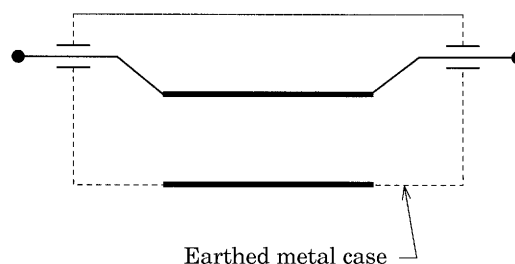


Figure 4b Lead-through capacitor for asymmetrical use (non-coaxial)

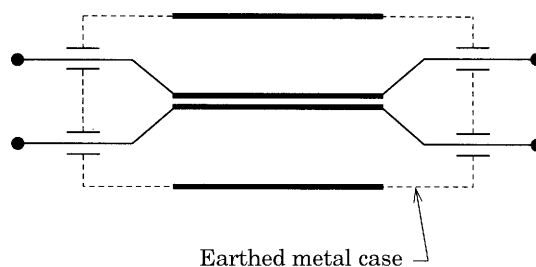


Figure 4c Multiple unit lead-through capacitor (non-coaxial) for symmetrical and asymmetrical use

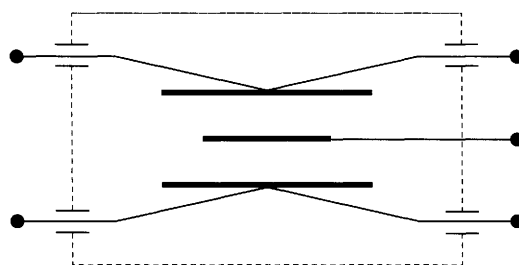


Figure 4d Multiple unit lead-through capacitor

Figure 4 Lead-through capacitors

1.5.9 by-pass capacitor

capacitor where radiofrequency interference currents are by-passed

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- or Y3-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 (L) and neutral terminals (N). 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.

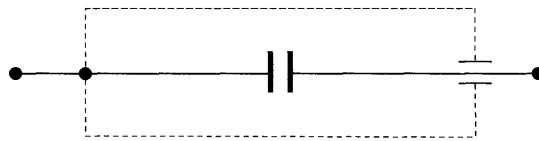


Figure 5a Single by-pass capacitor

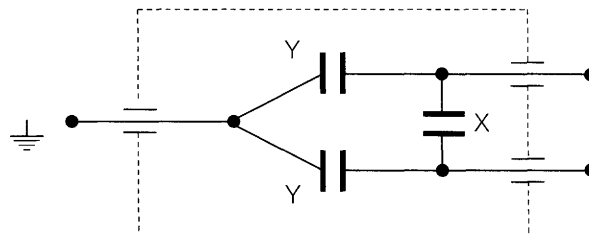


Figure 5b Delta by-pass capacitor

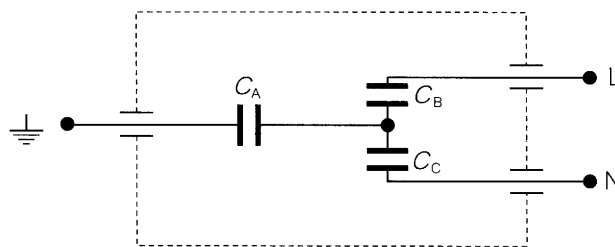


Figure 5c Example of a T-connected by-pass capacitor

NOTE : For capacitors with non-metallic housings, the earth connection is brought out as a separate termination.

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.

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 (see NOTE to 1.5)

NOTE 1 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 This definition replaces that given in **JIS C 5101-1, 2.2.14**, 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 (see NOTE to 1.5)

NOTE : This definition replaces that given in **JIS C 5101-1, 2.2.15** (see NOTE 2 to 1.5.12 above).

2.2.15 of JIS C 5101-1 is equivalent to 2.2.13 of the corresponding International Standard IEC 60384-1 : 1999.

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 : This definition replaces that in **JIS C 5101-1, 2.2.16** (see NOTE 2 to 1.5.12 above).

2.2.16 of JIS C 5101-1 is equivalent to 2.2.15 of the corresponding International Standard IEC 60384-1 : 1999.

1.5.15 insertion loss

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

NOTE : 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

aperiodic 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 electrical loading

1.6 Marking

According to **2.4** of **JIS C 5101-1**, with the following details.

1.6.1 Marking on the capacitor and the package

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 its 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) rated capacitance(s) and rated resistance;
- f) rated voltage and nature of supply (alternating voltage may be indicated by the symbol $\sim$ and direct voltage by the symbol ----- or -----);
- 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.

1.6.2 Marking on the capacitor

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 only **a)** and **b)** are mandatory (see Annex F).

It is recommended that a caution mark be printed on the pc board where a safety component is mounted. The caution mark shall be as shown in **ISO 7000-0434 (DB:2004-01)**. The mark is in the form of an upright equilateral triangle containing an exclamation mark.

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

1.6.3 Marking on the package

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.

1.6.4 Additional marking

Any additional marking other than those specified in **1.6.1** shall be applied in such a way that no confusion can arise.

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 clause **8** of **JIS C 60068-1**.

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: $-65\text{ }^{\circ}\text{C}$, $-55\text{ }^{\circ}\text{C}$, $-40\text{ }^{\circ}\text{C}$, $-25\text{ }^{\circ}\text{C}$ and $-10\text{ }^{\circ}\text{C}$;

upper category temperature: $+85\text{ }^{\circ}\text{C}$, $+100\text{ }^{\circ}\text{C}$, $+105\text{ }^{\circ}\text{C}$, $+125\text{ }^{\circ}\text{C}$ and $+155\text{ }^{\circ}\text{C}$;

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**.

NOTE : The associated portion stated in **IEC 60940:1988** is given below.

4.3 Environmental classification (climatic category) This is comprised of three figures e.g. 25/085/21. This indicates that the lower category temperature is $-25\text{ }^{\circ}\text{C}$, the upper category temperature $+85\text{ }^{\circ}\text{C}$ and the duration of the damp heat, steady state test is 21 days.

When the suppression component is mounted and working in the equipment the case temperature should not be outside the category temperature range under any conditions of operation.

The selection of the humidity classification depends on the environment in which the equipment is expected to work. 21 days is frequently chosen for domestic appliances, for example.

2.2 Preferred values of ratings

2.2.1 Rated capacitance (C_R)

These values conform to the E6 series of preferred values given in **JIS C 5063**.

2.2.2 Tolerance on rated capacitance

The maximum tolerance on rated 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 and 760 V.

NOTE 1 X-capacitors can be used in a star connect.

NOTE 2 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.

2.2.4 Rated resistance (R_R)

Preferred values of rated resistance shall be taken from the E6 series of **JIS C 5063**.

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 minimum category of passive flammability permitted is Category C (see **4.17**).

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 **3.5.1** of **JIS C 5101-1** 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.

NOTE : **3.5.1** of **JIS C 5101-1** is equivalent to **3.10** of the corresponding International Standard **IEC 60384-1 : 1999**.

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, **JIS C 5101-1, 3.4**, in which **3.4.2 a)** 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 **3.4.2 b)** of **JIS C 5101-1** 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.

NOTE : **3.4** of **JIS C 5101-1** is equivalent to **3.5** of the corresponding International Standard **IEC 60384-1 : 1999** and **3.4.2, a) and b)** of **JIS C 5101-1** is equivalent to **3.5.3, a) and b)** of the corresponding International Standard **IEC 60384-1 : 1999**.

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 in **4.17**, Note ^{f)} to table 3 and Note ⁱ⁾ to table 4 shall be followed. For the active flammability test, the rules of sampling in **4.18** shall be followed. For RC units, the sample of highest capacitance values and the sample of the lowest capacitance values shall contain each, as nearly as possible, equal number of resistors of the highest and lowest resistance value in the range to be qualified. Where only one capacitance value is involved, the total number of capacitors as stated in tables 3, 4 and 5 shall be tested.

Spare specimens are permitted as follows:

- a) one per capacitance value which may be used to replace the permitted nonconforming item in Group 0;
- b) the remainder of the spare specimens may be required, if it is necessary, to repeat any test according to the provisions of Note ^{a)} of either tables 3 and 4.

The numbers given in Group 0 assume that all subgroups are applicable. If this is not so, the numbers may be reduced accordingly.

When additional groups are introduced into the qualification approval test schedule, the number of specimens required for Group 0 shall be increased by the same number as that required for the additional groups.

Tables 3, 4 and 5 give the number of specimens to be tested in each group or subgroup together with the permissible number of nonconforming items in each case.