

**Harmonized system of
quality assessment for
electronic
components —
Fixed capacitors for
use in electronic
equipment —
Sectional specification:
Fixed metallized
polypropylene film
dielectric a.c. and pulse
capacitors**

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- Electronic Components Industry Federation
- Electronic Engineering Association
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National foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee. It is identical with IEC Publication 384-17 (QC 301300) “*Fixed capacitors for use in electronic equipment — Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors*” published in 1987 by the International Electrotechnical Commission (IEC). The UK has played an active part in the development of the IEC Publication.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards.

Cross-references. The British Standard which implements IEC Publications QC 001001:1986 and QC 001002:1986 is BS 9000: “*General requirements for a system for electronic components of assessed quality*” Part 3:1987 “*Specification for national implementation of IECQ basic rules and rules of procedure*”.

International Standard	Corresponding British Standard
IEC 62:1974	BS 1852:1975 <i>Specification for marking codes for resistors and capacitors</i> (Identical)
IEC 63:1963	BS 2488:1966 <i>Schedule of preferred numbers for the resistance of resistors and the capacitance of capacitors for telecommunication equipment</i> (Technically equivalent)
IEC 68-1:1982	BS 2011 <i>Basic environmental testing procedures</i> Part 1.1:1983 <i>General and guidance</i> (Identical)
IEC 384-1:1982 (QC 300000)	BS QC 300000:1983 <i>Specification for harmonized system of quality assessment for electronic components. Fixed capacitors for use in electronic equipment^a</i> <i>Generic specification</i> (Identical)
IEC 410:1973	BS 6001 <i>Sampling procedures for inspection by attributes</i> Part 1:1972 <i>Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection</i> (Technically equivalent)
ISO 3:1973	BS 2045:1965 <i>Preferred numbers</i> (Technically equivalent)

^a Formerly BS 9930-0:1983.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 General

1.1 Scope

This standard applies to fixed capacitors with metallized electrodes and polypropylene dielectric for use in electronic equipment.

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

These capacitors may have “self-healing” properties depending on conditions of use. Capacitors covered by this specification are mainly intended for use with alternating voltage and/or for pulse applications. The maximum reactive power applicable is 10 000 var and the maximum peak voltage is 3 000 V.

This standard is not intended to cover capacitance values higher than 20 μF .

Capacitors for reactive power exceeding 500 var at 50 Hz are not covered by this standard except when they are the highest part of a range of reactive powers mainly situated below 500 var at 50 Hz.

The maximum peak voltage is 2 500 V. Two performance grades of capacitors are covered, grade 1 for long-life application and grade 2 for general application.

Capacitors for radio interference suppression are not included, but are covered by IEC Publication 384-14: Fixed Capacitors for Use in Electronic Equipment. Part 14: Sectional Specification: Fixed Capacitors for Radio Interference Suppression. Selection of Methods of Test and General Requirements.

Capacitors for electrical shock hazard protection (covered by IEC Publication 65) and fluorescent lamp and motor capacitors (covered by IEC TC 33 and TC 34 specifications) are also excluded.

1.2 Object

The object of this standard is to prescribe preferred ratings and characteristics and to select from IEC Publication 384-1 (1982), 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, because lower performance levels are not permitted.

1.3 Related documents

IEC Publications:

Publication 62:(1974) *Marking Codes for Resistors and Capacitors.*

Publication 63:(1963) *Preferred Number Series for Resistors and Capacitors.*
Amendment No.1 (1967)
Amendment No.2 (1977)

Publication 68: *Basic Environmental Testing Procedures.*

Publication 384-1:(1982) *Fixed Capacitors for Use in Electronic Equipment — Part 1: Generic Specification.*
Amendments No.1 (1985) and No.2 (1987).

Publication 410:(1973) *Sampling Plans and Procedures for Inspection by Attributes.*

Publication
QC 001001:(1986) *Basic Rules of the IEC Quality Assessment System for Electronic Components (IECQ).*

Publication
QC 001002:(1986) *Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ).*

ISO Publication:

ISO Standard 3:(1973) *Preferred Numbers — Series of Preferred Numbers.*

NOTE The above references apply to the current editions except for IEC 68, for which the referenced edition in the applicable test clauses of the generic specification shall be used.

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 Sub-clause 1.9 of the detail specification and indicated in the test schedules, for example by an asterisk.

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

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

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 of the body, the 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 items (capacitance values/voltage ranges) are covered by a detail specification, the dimensions and their associated tolerances shall be placed in a table below the drawing.

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

1.4.2 Mounting

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

1.4.3 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 Sub-clause 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 the qualified products list."

1.4.3.2 Sinusoidal current (if applicable)

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

1.4.3.3 Particular characteristics

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

1.4.3.4 Soldering

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

1.4.4 Marking

The detail specification shall specify the content of the marking on the capacitor and on the package. Deviations from Sub-clause 1.6 of this sectional specification shall be specifically stated.

1.5 Terminology

In addition to the applicable terms and definitions of IEC Publication 384-1 the following definitions apply:

1.5.1 Performance grades

1.5.1.1 Performance grade 1 capacitors (long-life)

Capacitors intended for long-life application with stringent requirements for the electrical parameters.

1.5.1.2 Performance grade 2 capacitors (general purpose)

Capacitors for general application where the stringent requirements of performance grade 1 are not necessary.

1.5.2 Stability grade

It is defined by the capacitance drift after climatic and mechanical tests and after endurance tests. The performance grade and the stability grade shall be noted in the detail specification.

1.5.3 Performance grade and stability grade combinations (if stability grade is required for a.c. and pulse capacitors)

The table below shows the combinations of the performance grade and the stability grade (for preferred values):

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

The three combinations of performance grades and stability grades concern capacitance stability and $\tan \delta$ values. Distinction in performance of the three combinations is shown in Table II, page 8.

1.5.4 Rated voltages

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

1.5.4.1 Rated d.c. voltage

The maximum d.c. voltage which may be applied continuously to a capacitor at the rated temperature.

1.5.4.2 Rated a.c. voltage

The maximum r.m.s. alternating voltage which may be applied continuously to a capacitor at the rated temperature and at a given frequency.

1.5.4.3 Rated pulse voltage

Peak value of the pulse voltage which may be applied continuously to a capacitor at the rated temperature and at a given frequency.

1.5.5 Rated voltage pulse slope $\frac{(dU)}{(dt)_R}$ (if applicable)

The rated pulse slope $\frac{(dU)}{(dt)_R}$ is the maximum admissible value of the voltage slope $\frac{dU}{dt}$ of a pulse, at the rated temperature at such a repetition frequency that no significant increase of temperature occurs.

1.6 Marking

Sub-clause 2.4 of IEC Publication 384-1, with the following details:

1.6.1 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:

- rated capacitance;
- rated a.c. and/or pulse voltage (a.c. voltage may be indicated by the symbol ~) and the corresponding frequency if different from 50 Hz;
- tolerance on rated capacitance;
- rated voltage pulse slope (if applicable);
- rated current and corresponding frequency (if applicable);
- year and month (or week) of manufacture;

- g) manufacturer's name or trade mark;
- h) climatic category;
- i) manufacturer's type designation;
- j) reference to the detail specification.

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

1.6.3 The package containing the capacitor(s) shall be clearly marked with all the information listed in Sub-clause 1.6.1.

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

Section 2. Preferred ratings and characteristics

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 specification are classified into climatic categories according to the general rules given in IEC Publication 68-1.

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: -55°C , -40°C , -25°C and -10°C

Upper category temperature: $+70^{\circ}\text{C}$, $+85^{\circ}\text{C}$ and $+100^{\circ}\text{C}$

Duration of the damp heat, steady state test: 4, 10, 21 and 56 days

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

2.2 Preferred values of ratings

2.2.1 Rated capacitance (C_R)

Preferred values of rated capacitance are values chosen from the E series of preferred values given in IEC Publication 63: Preferred Number Series for Resistors and Capacitors.

2.2.2 Tolerances on rated capacitance

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

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

2.2.3 Rated capacitance with associated tolerance values

For preferred combinations of capacitance series and tolerances see the table hereafter:

2.2.4 Rated a.c. voltage ($U_{\text{R.a.c.}}$ or $U_{\text{R}\sim}$)

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

The preferred values of rated a.c. voltage (r.m.s. value) shall be chosen from the R10 or R20 series given in ISO Standard 3: Preferred numbers — Series of preferred numbers.

The detail specification shall give the derating curve of the admissible r.m.s. voltage versus temperature (higher than rated temperature) and, if applicable, versus frequency.

2.2.5 Category a.c. voltage ($U_{Ca.c.}$ or $U_{C\sim}$)

The category a.c. voltage is equal to the rated a.c. voltage $U_{Ra.c.}$ for upper category temperatures up to 85 °C. At an upper category temperature of 100 °C the voltage is 0.7 $U_{R\sim}$.

2.2.6 Rated temperature

For upper category temperatures ≥ 85 °C the rated temperature is 85 °C and for an upper category temperature < 85 °C the rated temperature is equal to the upper category temperature.

NOTE A.C. rated temperature is 15 °C less than d.c. rated temperature.

2.2.7 Rated a.c. current (when required in the detail specification)

The detail specification shall state:

- the frequency
- the r.m.s. value of the rated a.c. current applicable at the specified frequency (value chosen from R10 or R20 series)
- the derating curve of the admissible a.c. current versus ambient temperature.

Section 3. Quality assessment procedures

3 Quality assessment procedures

3.1 Primary stage of manufacture

The primary stage of manufacture is the winding of the capacitor element or the equivalent operation.

3.2 Structurally similar components

Capacitors considered as being structurally similar are capacitors produced with similar processes and materials, though they may be of different case sizes and values.

3.3 Certified records of released lots

The information required in Sub-clause 3.5.1 of IEC Publication 384-1 shall be made available when prescribed in the detail specification and when requested by a purchaser. After the endurance test the parameters for which variables information is required are the capacitance change and $\tan \delta$. The insulation resistance is only required by attribute.

3.4 Qualification approval

The procedures for Qualification Approval testing are given in Sub-clause 3.4 of the Generic Specification, IEC Publication 384-1.

The schedule to be used for Qualification Approval testing on the basis of lot-by-lot and periodic tests is given in Sub-clause 3.5 of this specification. The procedure using a fixed sample size schedule is given in Sub-clauses 3.4.1 and 3.4.2 below.

3.4.1 Qualification approval on the basis of the fixed sample size procedures

Sampling

The fixed sample size procedure is described in IEC Publication 384-1, Sub-clause 3.4.2 b). The sample shall be representative of the range of capacitors for which approval is sought. This may or may not be the complete range covered by the detail specification.

The sample shall consist of specimens having the lowest and highest voltages, and for these voltages the lowest and highest capacitances. When there are more than four rated voltages an intermediate voltage shall also be tested. Thus for the approval of a range, testing is required for either four or six values (capacitance/voltage combinations). When the range consists of less than four values, the number of specimens to be tested shall be that required for four values.

Spare specimens are permitted as follows:

- a) One per value which may be used to replace the permitted defective in Group “0”.
- b) One per value which may be used as replacements for specimens which are defective because of incidents not attributable to the manufacturer.

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