

**Harmonized system of quality
assessment for electronic components**

**Sectional specification:
Passive filter units for
electromagnetic
interference
suppression (Filters for
which safety tests are
required)**

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Committees responsible for this British Standard

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- BSI Testing Services
- Electrical Installation Equipment Manufacturers' Association
- Federation of Electronics Industry
- Ministry of Defence
- National Supervising Inspectorate (BSI-PC)
- Society of British Aerospace Companies Limited

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National foreword

This British Standard has been prepared by Subcommittee EPL/40/1 and is the English language version of EN 133200:1995 *Sectional Specification: Passive filter units for electromagnetic interference suppression (Filters for which safety tests are required)*, published by the European Electronic Components Committee (CECC) of the European Committee for Electrotechnical Standardization (CENELEC).

Cross-references

Publication referred to	Corresponding British Standard
EN 60062:1993 (IEC 62:1992)	BS EN 60062:1994 <i>Marking codes for resistors and capacitors</i>
EN 100114-1:1994	BS EN 100114 <i>Rule of procedure 14. Quality assessment procedures</i> Part 1:1994 <i>Approval of manufacturers and other organizations</i>
EN 132400:1994	BS EN 132400:1995 <i>Harmonized system of quality assessment for electronic components. Sectional Specification. Fixed capacitors for electromagnetic interface suppression and connection to the supply mains (Assessment level D)</i>
IEC 60-1:1989	BS 923 <i>Guide on high-voltage testing techniques</i> Part 1:1990 <i>General</i>
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>
IEC 68	BS 2011 <i>Environmental testing</i>
IEC 85:1984	BS 2757:1986 <i>Method for determining the thermal classification of electrical insulation</i>
IEC 294:1969	BS 5692:1979 <i>Method for measurement of the dimensions of a cylindrical electronic component having two axial terminations</i>
IEC 664:1980 IEC 664A:1981	PD 6499:1981 <i>Guide to insulation co-ordination within low-voltage systems including clearances and creepage distances for equipment</i>

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 36, 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.

UDC

Descriptors: Quality, electronic components, capacitors

English version

Sectional Specification:
Passive filter units for electromagnetic interference
suppression
(Filters for which safety tests are required)

Spécification intermédiaire:
Filters passifs d'antiparasitage
(Filtres pour lesquels les essais de sécurité sont
exigés)

Rahmenspezifikation:
Passive Filter für die Unterdrückung von
elektromagnetischen Störungen
(Filter für die Sicherheitsprüfungen
vorgeschrieben sind)

This European Standard was approved by CENELEC Electronic Components Committee (CECC) on 26 March 1993. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the General Secretariat of the CECC or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CECC General Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. The membership of the CECC is identical, with the exception of the national electrotechnical committees of Greece, Iceland and Luxembourg.

CECC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby acceptable in all member countries without further testing.

This European Standard was prepared by CECC WG 3, Capacitors.

The text of the draft based on document CECC(Sec)2862 was submitted to the formal vote; together with the voting report, circulated as document CECC(Sec)3305. It was approved by CECC as EN 133200 on 26 March 1993.

The text of EN 133200 is based on the following documents:

- CECC CECC(Sec)2862/09.91
[RV CECC(Sec)3305/02.93]

The following dates were fixed:

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- latest declaration of NS obsolescence 1994-01-23
- latest date of withdrawal of conflicting national standards (dow) 2003-07-23

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1 General

1.1 Scope

This specification applies to passive filter units for electromagnetic interference suppression which fall within the scope of the Generic Specification EN 133000.

The scope of this specification is restricted to passive filter units for which safety tests are appropriate. This implies that filters specified according to this specification will either be connected to mains supplies, when compliance with the mandatory tests of Table 2 is necessary, or used in other circuit positions where the equipment specification prescribes that some or all of these safety tests are required.

This specification applies to passive filter units which will be connected to an a.c. mains or other supply with a nominal voltage not exceeding 500 V a.c. (r.m.s.) between conductors or 250 V a.c. (r.m.s.) between any one conductor and earth and with a nominal frequency not exceeding 400 Hz.

This specification also provides a schedule of safety tests to be used by National Testing Stations in countries where approval by such stations is required.

1.2 Related documents

EN 100114-I:1994, *Approval of manufacturers and other organizations.*

EN 132400:1994, *Fixed Capacitors for Use in Electronic Equipment. Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains.*

EN 133000:1995, *Passive filter units for Electromagnetic Interference Suppression: Generic Specification.*

EN 130400, *Sectional Specification: Fixed metallized polyethylene-terephthalate film dielectric capacitors for direct current.*

EN 130500, *Sectional Specification: Fixed metallized polycarbonate film capacitors for direct current.*

EN 130600, *Sectional Specification: Fixed capacitors with ceramic dielectric, class 1.*

EN 130700, *Sectional Specification: Fixed capacitors with ceramic dielectric, class 2.*

EN 133100, *Passive filter units for Electromagnetic Interference Suppression: Sectional Specification — Filters for which safety tests are not required.*

IEC 62:1992, *Marking Codes for Resistors and Capacitors.*

Amendment No 1 (1988)

IEC 60-1:1989, *High-voltage Test Techniques Part 1: General Definitions and Test Requirements.*

IEC 63:1963, *Preferred Number Series for Resistors and Capacitors.*

Amendment No 1 (1967)

Amendment No 2 (1977)

IEC 68, *Basic Environmental Testing Procedures.*

IEC 85:1984, *Thermal Evaluation and Classification of Electrical Insulation.*

IEC 279:1969, *Measurement of the Winding Resistance of an A.C. Machine during Operation at Alternating Voltage.*

IEC 294:1969, *Measurement of the Dimensions of a Cylindrical Component having two Axial Terminations.*

IEC 335-1:1976, *Safety Household and similar Electrical Appliances.*

IEC 410:1973, *Sampling Plans and Procedures for Inspection by Attributes.*

IEC 536:1975, *Memorandum. Construction of Electrical Equipment for Protection against Electric Shock.*

Amendment No 1 (1976)

IEC 664:1980 and 664A:1981, *Insulation Co-ordination within Low-voltage Systems including Clearances and Creepage Distances for Equipment.*

IEC 938:1988, *Fixed Inductors for Radio Interference Suppression.*

IEC 939:1988, *Complete Filter Units for Radio Interference Suppression.*

IEC 940:1988, *Guidance Information on the Application of Capacitors, Resistors, Inductors and Complete Filter Units for Radio Interference Suppression.*

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

1.3 Information to be given in a detail specification

The 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.

NOTE The information given in 1.3.1 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 the appropriate clause of this sectional specification.

1.3.1 Outline drawing and dimensions

There shall be an illustration of the filter as an aid to easy recognition and for comparison of the filter 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.

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 range of filters is covered by a single detail specification, their dimensions and their associated tolerances shall be placed in a table following the drawing.

In addition the detail specification shall state such other dimensional information as will adequately describe the filter outline.

1.3.2 Mounting

The detail specification shall specify the method of mounting recommended for normal use and the method which is mandatory for the application of the vibration, bump, shock and endurance tests. The design of the filter may be such that special mounting fixtures or heat sinks 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. The specified heat sink shall be used in the application of the endurance test.

NOTE If recommendations for mounting for “normal” use are made, they shall be included in the detail specification under 1.8 “Additional information (not for inspection purposes)”. If they 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.

1.3.3 Ratings and characteristics

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

1.3.3.1 *Particular characteristics*

Additional characteristics may be listed when they are considered necessary to specify adequately the filter for design or application purposes.

1.3.4 Marking

The detail specification shall specify the content of the marking on the filter and the package.

1.4 Terminology

In addition to 2.2 of EN 133000 the following definitions apply :

1.4.1

A.C. mains filter (or mains filter)

a passive filter unit designed essentially for application with a power-frequency alternating voltage supplied from the mains. Depending on their circuit position, the capacitor elements in such filters are required to meet the requirements for Class X or Class Y capacitors

1.4.2

class X capacitor

a capacitor of a type suitable for use in situations where failure of the capacitor would not lead to danger of electric shock

class X capacitors are divided into three sub-classes (see Table 1A) according to the peak voltage of the impulsessuperimposed 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 1A

Sub-class	Peak pulse voltage in service	IEC 664 installation category	Application	Peak impulse voltage U_P ; applied before endurance test
X1	$> 2,5 \text{ kV}$ $\leq 4,0 \text{ kV}$	III	High pulse application	When $C_R \leq 1,0 \mu\text{F}$: $U_P = 4,0 \text{ kV}$ When $C_R > 1,0 \mu\text{F}$: $U_P = \frac{4}{\sqrt{C_R}} \text{ kV}$
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 $C_R > 1,0 \mu\text{F}$: $U_P = \frac{2,5}{\sqrt{C_R}} \text{ kV}$
X3	$\leq 1,2 \text{ kV}$	—	General purpose	None

NOTE 1 C_R is in μF .NOTE 2 The factor used for the reduction of U_P for capacitance values above $1\mu\text{F}$ maintains $0,5 C_R U_P^2$ constant for these C values.

NOTE 3 The sub-class X3 corresponds to the sub-class X2 described in Table 1 of IEC 384-1 Edition 1.

1.4.3 class Y capacitor

NOTE This definition is identical with that in 1.5.4 of IEC 384-14 Edition 2.

a 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 sub-classes Y1, Y2, Y3 and Y4, as shown in Table 1B

Table 1B

Sub-class	Type of insulation bridged	Range of rated voltages	Peak impulse voltage before endurance test
Y1	Double insulation or reinforced insulation	$\leq 250 \text{ V}$	8,0 kV
Y2	Basic insulation or supplementary insulation	$\geq 150 \text{ V}$ $\leq 250 \text{ V}$	5,0 kV
Y3	Basic insulation or supplementary insulation	$\geq 150 \text{ V}$ $\leq 250 \text{ V}$	none
Y4	Basic insulation or supplementary insulation	$< 150 \text{ V}$	2,5 kV

NOTE 1 For definitions of basic, supplementary, double and reinforced insulation see IEC 536 sub-clauses 2.1, 2.2, 2.3 and 2.4.

NOTE 2 The sub-class Y3 corresponds to the class Y described in sub-clause 4.4 of IEC 384-1 Edition 1.

Y1-capacitors shall not form part of a combined capacitor in the same enclosure, such as a delta capacitor. Otherwise separate elements may be built together from Y-capacitors and X-capacitors if they fulfil the requirements for the relevant X and Y sub-classes

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 must have the same nominal value

1.5 Marking

1.5.1 See 2.4 of EN 133000 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) Recognized approval mark
- d) Rated voltage and rated frequency
- e) Identification of terminations and/or circuit diagram
- f) Rated current
- g) Rated temperature
- h) Climatic category
- j) Year and month (or week) of manufacture (may be indicated by the code given in IEC 62)
- k) Reference to the detail specification.

1.5.2 The filter shall be clearly marked with a), b), c) and d), and also e) if this is not implied by b).

1.5.3 The package containing the filter(s) shall be clearly marked with all the information listed in **1.5.1**. National approvals may be indicated by lettering as an alternative to the approval mark.

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

2 Preferred ratings and characteristics

2.1 Preferred characteristics

The values given in detail specifications should preferably be selected from the following:

2.1.1 Preferred climatic categories

The filters covered by this specification are classified into climatic categories according to the general rules given in IEC 68-1.

The lower and upper category temperature and the duration of the damp heat, steady state test should 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: $+70\text{ }^{\circ}\text{C}$, $+85\text{ }^{\circ}\text{C}$, $+100\text{ }^{\circ}\text{C}$, $+125\text{ }^{\circ}\text{C}$ 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 940.

2.2 Preferred values of ratings

2.2.1 Rated voltage (U_R)

The preferred values of rated voltage are:

115 V, 230 V, 250 V, 400 V and 440 V.

NOTE Electromagnetic interference suppression filters shall 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 filters should take into account the possibility that the voltage of the system may rise by up to 10 % above its nominal voltage.

2.2.2 Category voltage (U_C)

The category voltage is equal to the rated voltage unless otherwise stated in the detail specification.

2.2.3 Rated temperature

The rated temperature shall not be less than $+40\text{ }^{\circ}\text{C}$.

2.2.4 Passive flammability

When specified the minimum category of passive flammability permitted is category C.

3 Quality assessment procedures

3.1 Primary stage of manufacture

See 3.2 of EN 133000.

3.2 Structurally similar filters

See 3.2 of EN 100114-1 and 3.3 of EN 133000.

In addition to these provisions, filters may be considered as structurally similar only when for their range of component values they have the same capacitor, inductor and resistor technologies and corresponding capacitive elements are of the same sub-class.

3.3 Certified records of released lots

The information required in 3.5.1 of EN 133000 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 insertion loss change and insulation resistance.

3.4 Approval testing

3.4.1 Approval by National Testing Stations

Table 2 is a schedule limited to tests concerning safety requirements to be used by National Testing Stations in countries where approval by such stations is required. Fixed sample size testing is employed according to the provisions of 3.4.3, and a restricted list of measurements after conditioning is used as specified in Annex B.

3.4.2 CECC qualification approval

Table 3, Table 4 and Table 5 are to be used when CECC qualification approval is sought to a detail specification written according to CECC rules; these tables include both safety and performance tests.

The procedures for qualification approval testing are given in 3.4 of the Generic Specification EN 133000. 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 and Table 4 and Table 5 of this specification. The procedure using a fixed sample size schedule is given in 3.4.3 and Table 3 below. For the two procedures the sample sizes and the number of non-conforming items shall be of comparable order. The test conditions and requirements shall be the same. Qualification approval according to the fixed sample sizes of Table 3 is preferred.

3.4.3 Sampling

Filter types to be qualified together shall have the same rated voltage, and combination of component technologies; in addition the corresponding capacitive elements shall be of the same sub-class. The numbers of filters required for each qualification in each group are given in Table 2 and Table 3.

For each qualification the sample shall contain equal numbers of specimens of the highest and lowest total capacitance values in the range to be qualified. Where only one total capacitance value is involved, the total number of filters as stated in Table 2 and Table 3 shall be tested.

If for a given value of total capacitance there is more than one rated current available in the range, then filters with the highest rated current shall be chosen. If at this rated current more than one inductance value is available in the range, then filters with the highest inductance value shall be chosen.

NOTE "Total capacitance" in the clause above means the capacitance measured at low frequency between the input terminations of the filter.

Spare specimens are permitted as follows:

- a) One per value which may be used to replace the non-conforming item in Group 0.
- b) One per value which may be used as replacements for non-conforming specimens because of incidents not attributable to the manufacturer.
- c) Sufficient specimens to enable the repeat test of note 8 to Table 2 and Table 3 to be carried out.

The numbers given in Group 0 assume that all further groups are applicable. If this is not so, the numbers may be reduced accordingly. The numbers given in Group 0 may also be reduced if, for example for expensive filters, the manufacturer chooses to carry out the tests of a number of groups in sequence on the same specimens. The numbers given for Group 0 do not include the specimens required for Groups 7 and 8.