SLOVENSKI STANDARD
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Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains (Assessment level D)

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Rahmenspezifikation: Festkondensatoren zur Unterdrückung elektromagnetischer Störungen, geeignet für Netzbetrieb (Gütebestätigungsstufe D)

Spécification intermédiaire: Condensateurs fixes d'antiparasitage et raccordement à l'alimentation (Niveau d'assurance D)

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Sectional Specification:

Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains

(Assessment Level D)

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Festkondensatoren zur Unterdrückung elektromagnetischer Störungen, geeignet für Netzbetrieb
(Gütebestätigungsstufe D)

This European Standard was approved by the CENELEC Electronic Components Committee (CECC) on 21 November 1993. CENELEC members are bound to comply with 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

CENELEC Electronic Components Committee
Comité des Composants Electroniques du CENELEC
CENELEC- Komitee für Bauelemente der Elektronik
General Secretariat: Gartenstr. 179, D-60596 Frankfurt

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 32 400 was submitted to the formal vote; together with the voting report, circulated as document CECC(Sec)3457, it was approved by CECC as EN 132 400 on 21 November 1993.

The text of EN 132 400 is based on the following documents;

- CECC 32 400 Issue 1 (1992) and
- CECC(Sec)3258/11.92 [RV CECC(Sec)3458/10.93].

The following dates were fixed:

-	latest date of announcement of the EN at national level	(doa)	1993-12-26
-	latest date of publication of an identical national standard	(dop)	1994-06-26
-	latest date of withdrawal of conflicting national standards	(dow)	1995-06-26

CONTENTS

Section/Clause

1 - GENERAL

1.1 Scope

This specification applies to fixed capacitors and resistor-capacitor combinations for electromagnetic interference suppression (formerly called radio interference suppression) for use within, or associated with, electronic or electrical apparatus and machines where the capacitors will be connected to a mains supply with a voltage not exceeding 500 V d.c. or 500 V a.c. (r.m.s.) between conductors or 250 V d.c. or 250 V a.c. (r.m.s.) between any one conductor and earth and with a frequency not exceeding 100 Hz.

This specification prescribes tests which are appropriate when the suppression capacitor is to be connected to the supply mains. The relevant equipment specification may also prescribe other circuit positions where capacitors meeting the requirements of this specification shall be used.

Combinations of two or more capacitors within one enclosure are included within the scope of this specification.

Series resistor-capacitor combinations are within the scope of this specification provided that the resistor is in the same enclosure, and the resultant equivalent series resistance of the combination does not exceed 1 kΩ.

Parallel resistor-capacitor combinations where the resistor acts as a discharge resistor for the capacitor are within the scope of this specification.

Capacitors for special environmental conditions (e.g. drip-proof, splash-proof) may have to comply with additional requirements.

NOTE - For notes on the application of electromagnetic interference suppression capacitors see IEC-940.

1.2 Object

The principal object of this specification is to prescribe preferred ratings and characteristics and to select from EN 130 000, 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.

A further object of this specification 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 Related Documents

ISO 3 (1973)	Preferred Numbers - Series of Preferred Numbers
IEC 60-1 (1989)	High Voltage Test Techniques: Part 1: General Definitions and Test Requirements

IEC 60-2 (1973)	Part 2: Test Procedures
IEC 62 (1974) Amendment 2 (1989)	Marking Codes for Resistors and Capacitors
IEC 63 (1963) Amendment 1 (1967) Amendment 2 (1977)	Preferred Number Series for Resistors and Capacitors
IEC 68	Basic Environmental Testing Procedures
IEC 335-1 (1976) Amendment 4 (1984) Amendment 5 (1986) Amendment 6 (1988)	Safety of Household and Similar Electrical Appliances
IEC 384-14 (1993)	Fixed capacitors for electromagnetic interference suppression and connection to the supply mains
IEC 410 (1973)	Sampling Plans and Procedures for Inspection by Attributes
IEC 536 (1976)	Classification of Electrical and Electronic Equipment with Regard to Protection Against Electrical Shock
IECs 664/664A (1980/1981)	Insulation Coordination within Low-Voltage Systems Including Clearances and Creepage Distances for Equipment
IEC 685	Connecting Devices (Junction and/or Tapping) for Household and Similar Fixed Electrical Installations
IEC 695-2-2 (1980)	Fire Hazard Testing Part 2 : Test Methods Needle Flame Test
IEC 760 (1989)	Flat, Quick-Connect Terminations
IEC 940 (1988)	Guidance Information on the Application of Capacitors, Resistors, Inductors and Complete Filter Units for Radio Interference Suppression
CISPR IEC 17 (1981)	Methods of Measurement of the Suppression Characteristics of Passive Radio Interference Filters and Suppression Components
Guide 104 (1984)	Guide to the Drafting of Safety Standards, and the Role of Committees with Safety Pilot Functions and Safety Group Functions
EN 130 000 (1993)	Generic Specification: Fixed Capacitors

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.

NOTE - The information given in 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 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, 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 the application of the vibration and the bump or shock tests. 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.

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.

1.4.3 Ratings and characteristics

The ratings and characteristics shall be in accordance with the relevant clauses of Section Two 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 CECC 00 200 (Register of Firms, Products and Services Approved under the CECC System)."

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 adequately the component 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 Terminology

NOTE - Some definitions of EN 130 000 have been expanded and this is indicated in the definitions by reference to this note.

In addition to the applicable terms and definitions of EN 130 000, the following definitions apply:

1.5.1 A.C. capacitor

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

NOTE - A.C. capacitors may be used on d.c. supplies having the same voltage as the capacitor a.c. r.m.s. rated voltage.

1.5.2 Radio interference suppression capacitor
Electromagnetic interference suppression capacitor

A 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

A 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 electric shock.

Class X capacitors are divided into three sub-classes (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

Sub-class	Peak pulse voltage in service	IEC-664 installation category	Application	Peak impulse voltage Up applied before endurance test
X1	> 2,5 kV ≤ 4,0 kV	III	High pulse application	For C_R ≤ 1,0 µF: U_P = 4 kV For C_R > 1,0 µF: $U_P = 4/\sqrt{C_R}$ kV
X2	≤ 2,5 kV	II	General purpose	For C_R ≤ 1,0 µF: U_P = 2,5 kV For C_R > 1,0 µF: $U_P = 2,5/\sqrt{C_R}$ kV
X3	≤ 1,2 kV	-	General purpose	none

NOTE 1 - C_R is in microfarads

NOTE 3 - The sub-class X3 corresponds to the sub-class X2 described in Table 1 of IEC 384-14 Edition 1.

1.5.4 Capacitor or RC-unit of Class Y

A capacitor or RC-unit of class Y 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 2.

TABLE 2

Sub-class	Type of insulation bridged	Range of rated voltages	Peak impulse voltage before endurance test
Y1	Double insulation or reinforced insulation	≤ 250 V	8,0 kV
Y2	Basic insulation or supplementary insulation	≥ 150 V ≤ 250 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 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			

The enclosure of a Y1-capacitor shall not contain other components. 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 shall have the same nominal value.

1.5.5 Two-terminal capacitor

An electromagnetic interference suppression capacitor having two terminals. See Figure 1.

Figure 1 - Two-terminal capacitor

1.5.6 Series RC-unit

A functional combination of a resistor in series with a capacitor of class X or Y. See Figure 2.

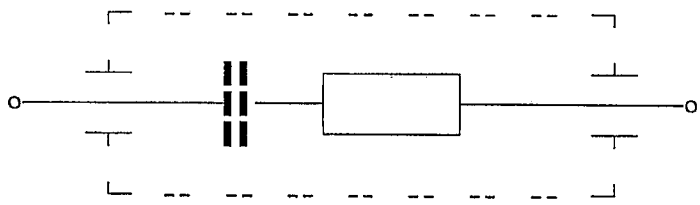

Figure 2 - RC unit

In this specification where the word "capacitor" appears the words "capacitor or RC-unit" shall be understood where the context permits.

1.5.7 Lead-through capacitor (coaxial)

A 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)

A capacitor in which the supply currents flow through or across the electrodes. See Figures 4a, 4b and 4c.

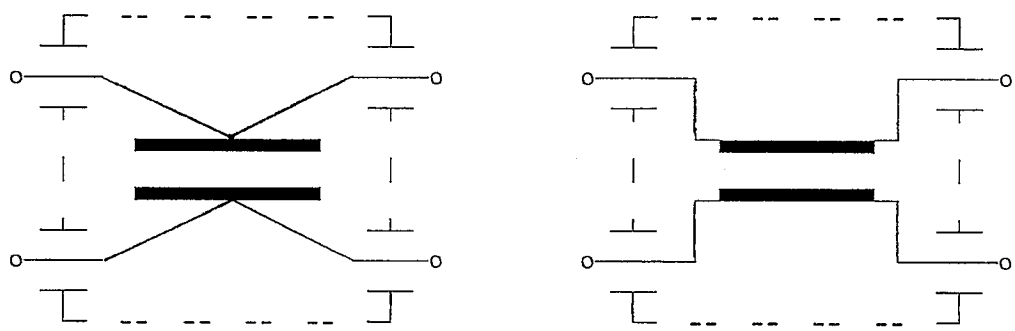

Figure 4a - Lead-through capacitor for symmetrical use (non-coaxial)

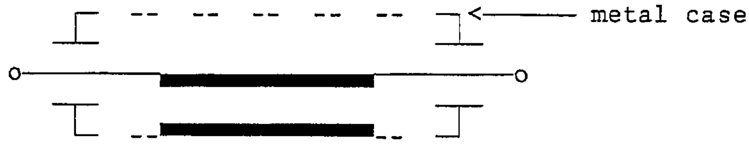

Figure 4b - Lead-through capacitor for asymmetrical use (non-coaxial)

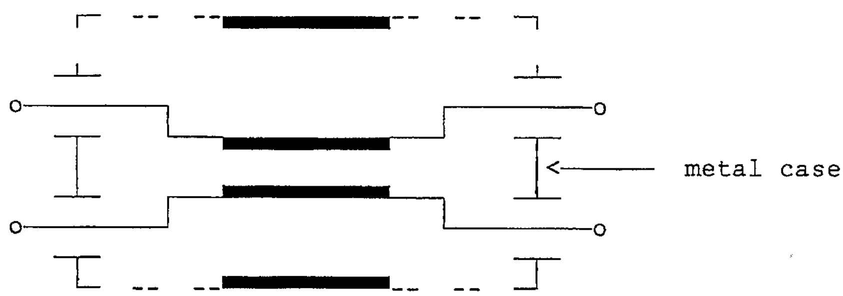

Figure 4c - Multiple unit lead-through capacitor (non-coaxial) **for symmetrical and asymmetrical use.**

1.5.9 By-pass capacitor

A capacitor where radio-frequency interference currents are by-passed. There are three common forms, single, delta and T-connected. The single capacitor employs 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 must be applied across the X-capacitors, such voltages shall be applied between the line and neutral terminations. Similarly when it is stated that voltages must be applied across the Y-capacitors, such voltages shall be applied between the line and neutral terminations connected together and the earth termination.

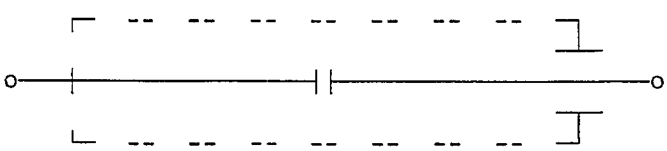

Figure 5a - Single by-pass capacitor

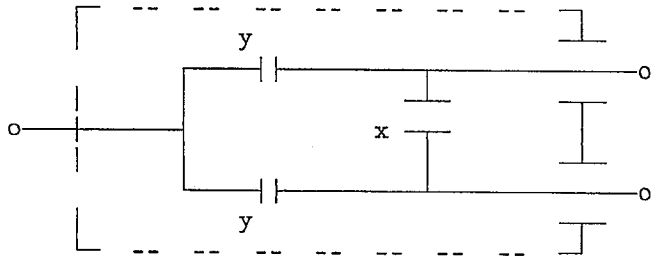

Figure 5b - Delta by-pass capacitor

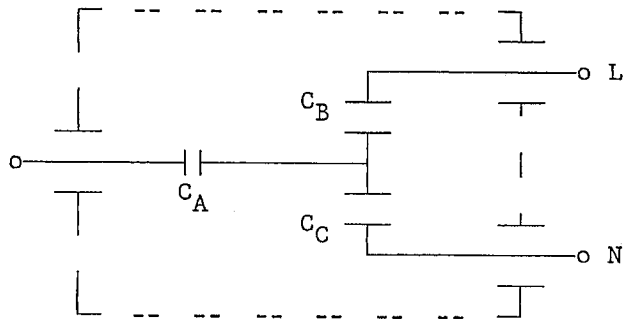

Figure 5c - Example of a T-connected by-pass capacitor

NOTE - For capacitors with non-metallic housings the earth connection will be brought out as a separate termination.

1.5.10 Rated voltage

The rated voltage is 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 specification, that the category voltage is the same as the rated voltage.

1.5.11 Rated power (of a series RC-unit)

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

1.5.12 Upper category temperature

The maximum surface temperature for which the capacitor has been designed to operate continuously (see note in 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 in 2.2.14 of EN 130 000, because suppression capacitors in accordance with this specification are intended to be connected to the mains network and may have internal heat generation as a result.

1.5.13 Lower category temperature

The minimum surface temperature for which the capacitor has been designed to operate continuously (see note in 1.5).

NOTE - This definition replaces that in 2.2.15 of EN 130 000 (see Note 2 in 1.5.12 above).

1.5.14 Rated temperature (of a lead-through capacitor or series RC-unit)

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

NOTE - This definition replaces that in 2.2.16 of EN 130 000 (see Note 2 in 1.5.12 above)

1.5.15 Insertion loss

The 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)

The 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)

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

1.5.18 Impulse voltage

An impulse voltage is an aperiodic transient voltage of a defined waveform as described in IEC 60-1.

1.5.19 Passive flammability

The 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

The ability of a capacitor to burn with a flame as a consequence of electrical loading.

1.6 Marking

See 2.4 of EN 130 000 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: