SLOVENSKI STANDARD
SIST EN 168000:2002 + A1:2002 + A2:2002

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Generic specification: Quartz crystal units

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Fachgrundspezifikation: Schwingquarze

Spécification générique: Résonateurs à quartz

Ta slovenski standard je istoveten z: **EN 168000:1993/A2:1998**

ICS:

31.140	Piezoelektriļ ne in dielektriļ ne naprave	Piezoelectric and dielectric devices

SIST EN 168000:2002 + A1:2002 + A2:2002 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 168000

March 1993

+A1 March 1993

+A2 February 1998

Supersedes CECC 68 000 Issue 1 : 1989

Descriptors: Quality, electronic components, quartz crystal units

English version

Generic Specification: Quartz Crystal Units

(Includes amendment A1 : 1993 and amendment A2 : 1998)

Spécification générique:
Résonateurs à quartz
(Inclut les amendements A1 : 1993 et A2 : 1998)

Fachgrundspezifikation:
Schwingquarze
(Enthält Änderungen A1 : 1993 und A2 : 1998)

This European Standard was approved by the CENELEC Electronic Components Committee (CECC) on 14th January 1992. 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

CENELEC Electronic Components Committee
Comité des Composants Electroniques du CENELEC
CENELEC-Komitee für Bauelemente der Elektronik

General Secretariat: Gartenstr. 179, W-6000 Frankfurt/Main 70

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 17, Piezoelectric devices for frequency control and selection.

The text of the draft based on document CECC 68 000 Isue 1 : 1989 (with A1) and CECC (Secretariat) 2851 was submitted to the formal vote for conversion to a European Standard; together with the voting report, circulated as document CECC (Secretariat) 2961 it was approved by CECC as EN 168 000 on 14 January 1992.

The following dates were fixed:

- latest date of announcement of the EN at national level (doa) 1992-12-08
- latest date of publication of an identical national standard (dop) 1993-06-08
- latest date of declaration of national standards obsolencence 1993-06-08
- latest date of withdrawal of conflicting national standards (dow) 2002-12-08

Foreword to amendment A2

This amendment to the European Standard EN 168000 : 1993 was prepared by CLC/TC CECC/SC 49 (former WG 17).

The text of the draft based on document CECC (Secretariat) 3332 was submitted to the formal vote; together with the voting report, circulated as document CECC (Secretariat) 3453, it was approved as amendment A2 to EN 168000 : 1993 on 1993-11-02.

NOTE. Amendment A1 : 1993 is included in EN 168000.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-08-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1999-08-01

CONTENTS

SECTION 1 - SCOPE

This document specifies the methods of test and general requirements for quartz crystal units of assessed quality using either capability approval or qualification approval procedures.

SECTION 2 - GENERAL

2.1 Order of precedence

Where any discrepancies occur for any reason, documents shall rank in the following order of precedence :

- the detail specification
- the sectional specification
- the generic specification
- the FEN internal regulations
- any other international documents (for example of the IEC) to which reference is made

The same order of precedence shall apply to equivalent national documents.

2.2 Related documents

ISO 1000	(1973)	SI units and recommendations for the use of their multiples and of certain other units
IEC 27-1	(1971)	Letter symbols to be used in electrical technology : Part 1 : General
IEC 27-2	(1972)	Letter symbols to be used in electrical technology : Part 2 : Telecommunications and electronics
IEC 50 (561)	-	International Electrotechnical Vocabulary Chapter 561: Piezoelectric devices for frequency control and selection
IEC 68	-	Basic environmental testing procedures
IEC 68-1	(1988)	Part 1 : General and guidance
IEC 68-2	-	Part 2 : Tests
IEC 68-2-1	(1990)	Test A : Cold
IEC 68-2-2	(1974) (1976)	Tests B : Dry heat Supplement A
IEC 68-2-3	(1969) (1984)	Test Ca : Damp heat, steady state Amendment No. 1
IEC 68-2-6	(1982) (1983) (1985)	Test Fc and guidance: Vibration (sinusoidal) Amendment No. 1 Amendment No. 2

IEC 68-2-7	(1983) (1986)	Test Ga : Acceleration, steady state Amendment No. 2
IEC 68-2-11	(1981)	Test Ka : Salt mist
IEC 68-2-14	(1984) (1986)	Test N : Change of temperature Amendment No. 1
IEC 68-2-17	(1978) (1989)	Test Q : Sealing Amendment No. 3
IEC 68-2-20	(1979) (1986) (1987)	Test T : Soldering Amendment No. 1 Amendment No. 2
IEC 68-2-21	(1983) (1985)	Test U : Robustness of terminations Amendment No. 1
IEC 68-2-27	(1987)	Test Ea : Shock
IEC 68-2-29	(1987)	Test Eb : Bump
IEC 68-2-30	(1980) (1985)	Test Db : Damp heat cyclic Amendment No. 1
IEC 68-2-32	(1975) (1990)	Test Ed : Free fall Amendment No. 2
IEC 68-2-45	(1980)	Test XA : Immersion in cleaning solvents
IEC 122-1	(1976) (1983)	Standard values and test conditions Amendment No. 1
IEC 122-3	(1977) (1984) (1979) (1980) (1981) (1989)	Standard outlines and pin connections Amendment No. 1 Supplement A Supplement B Supplement C Supplement D
IEC 302	(1969)	Standard definitions and methods of measurement for piezoelectric vibrators operating over the frequency range up to 30 MHz
IEC 410	(1973)	Sampling plans and procedures for inspection by attributes
IEC 444-1	(1986)	Basic method for the measurement of resonance frequency and resonance resistance of quartz crystal units by zero phase technique in a π - network
IEC 444-2	(1980)	Phase offset method for measurement of motional capacitance of quartz crystal units
IEC 444-3	(1986)	Basic method for the measurement of two terminal parameters of quartz crystal units up to 200 MHz by phase technique in a π network with compensation of the parallel capacitance C_o

IEC 444-4	(1988)	Method for the measurement of the load frequency F_L, load resonance resistance R_L and the calculation of other decimal values of quartz crystal units up to 30 MHz
IEC 617	-	Graphical symbols for diagrams
	(1986)	FEN internal regulations
IEC 695-2-2	(1980)	Fire hazard testing - Part 2: Test methods Needle-flame test
CECC 00 015/1	(1991)	Basic specification: Protection of electrostatic sensitive devices - Part 1: General requirements
CECC 00 114/I	Issue 1 (1991)	Quality assessment procedures. Part I : Approval of manufacturers and other organizations
CECC 00 114/II	Issue 1 (1991)	Quality assessment procedures. Part II : Qualification approval of electronic components
CECC 00 114/III	Issue 1 (1989)	Quality assessment procedures. Part III : Capability approval of electronic component manufacturing activity
CECC 00 109	(1974)	Certified test records
CECC 00 111	(1991)	Specifications
CECC 00 802	(1990)	CECC Standard method for specification of surface mounting components (SMDs) of assessed quality

2.3 Units, symbols and terminology

2.3.1 General

Units, graphical symbols, letter symbols and terminology shall, wherever possible, be taken from the following documents :

ISO 1000	SI units and recommendations for the use of their multiples and of certain other units
IEC 27	Letter symbols to be used in electrical technology
IEC 50	International Electrotechnical Vocabulary
IEC 617	Graphical symbols for diagrams

The following paragraphs contain additional terminology applicable to quartz crystal units.

2.3.2 Crystal element (crystal blank)

Piezoelectric material cut to a given geometric shape, size and orientation with respect to the crystallographic axes of the crystal.

2.3.3 Electrode

An electrically conductive plate or film in contact with, or in proximity to, a face of a crystal element by means of which an electric field is applied to the element.

2.3.4 Crystal vibrator

A mounted crystal element that vibrates when an alternating electric field exists between the electrodes.

2.3.5 Mounting

The means by which the crystal vibrator is supported (within its enclosure).

2.3.6 Enclosure

The enclosure protecting the crystal vibrator(s) and mounting.

2.3.7 Enclosure type

A crystal enclosure of specific outline dimensions and material with a defined method of sealing.

2.3.8 Crystal unit

A crystal vibrator mounted in an enclosure.

2.3.9 Socket

A component into which the crystal unit is inserted to hold the crystal unit and to provide electrical connection.

2.3.10 Mode of vibration

The pattern of motion in a vibrating body of the individual particles resulting from stresses applied to the body, the frequency of oscillation and the boundary conditions existing. The common modes of vibration are :

- flexural
- extensional
- face shear
- thickness shear.

2.3.11 Fundamental crystal unit

A crystal vibrator designed to operate at the lowest order of a given mode.

2.3.12 Overtone crystal unit

A crystal vibrator designed to operate at a higher order than the lowest of the given mode.

2.3.13 Overtone order

The numbers allotted to the successive overtones of a given mode of vibration from the ascending series of integral numbers commencing with the fundamental as unity. For face shear and extensional modes, this overtone is the integral multiple of the fundamental frequency to which the overtone frequency approximates.

2.3.14 Crystal unit equivalent circuit

The electric circuit which has the same impedance as the crystal unit in the region of the desired resonance and anti-resonance frequencies. It is represented by an inductance, capacitance and resistance in series, this series arm being shunted by the capacitance between the terminals of the unit. The parameters of the series branch of inductance, capacitance and resistance are given by L_1, C_1 and R_1 respectively; these are termed 'motional parameters' of the crystal unit. The shunt (parallel capacitance) is denoted by C_o (see Fig. 1).

Note 1 : The equivalent circuit does not represent all the characteristics of a crystal unit.

Note 2 : The values of R_e, X_e, G_p and B_p vary rapidly around the resonance frequency, where

R_e is the equivalent circuit series resistance of the vibrator.

X_e is the equivalent circuit series reactance of the vibrator.

G_p is the equivalent circuit parallel conductance of the vibrator.

B_p is the equivalent circuit parallel susceptance of the vibrator.

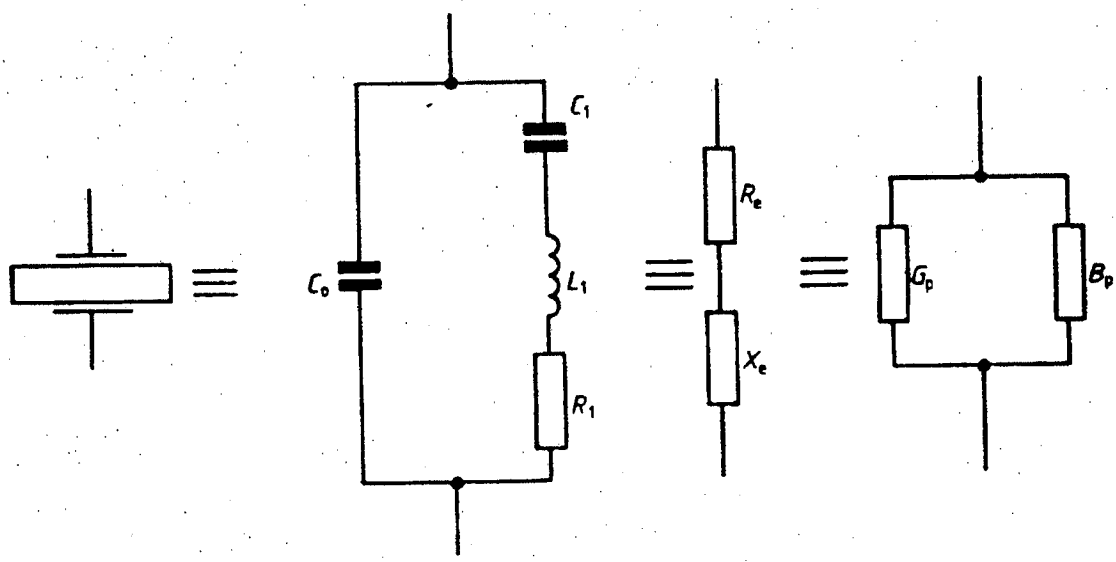


Figure 1. Symbol and equivalent electrical circuit of a piezoelectric vibrator near a resonance.

2.3.15 Motional resistance (R_1)

The resistance in the motional (series) arm of the equivalent circuit.

2.3.16 Motional inductance (L_1)

The inductance in the motional (series) arm of the equivalent circuit.

2.3.17 Motional capacitance (C_1)

The capacitance of the motional (series) arm of the equivalent circuit.

2.3.18 Shunt capacitance (C_o)

The shunt capacitance in parallel with the motional arm of the equivalent circuit.

2.3.19 Resonance frequency (f_r)

The lower of the two frequencies of the crystal unit alone, under specified conditions, at which the electrical impedance of the crystal is resistive.

2.3.20 Resonance resistance (R_r)

The resistance of the crystal unit alone at the resonance frequency f_r

2.3.21 Anti-resonance frequency (f_a)

The higher of the two frequencies of a crystal unit alone, under specified conditions, at which the electrical impedance of the crystal is resistive.

2.3.22 Load capacitance (C_L)

The effective external capacitance associated with the crystal unit which determines the load resonance frequency (f_L).

2.3.23 Load resonance frequency (f_L)

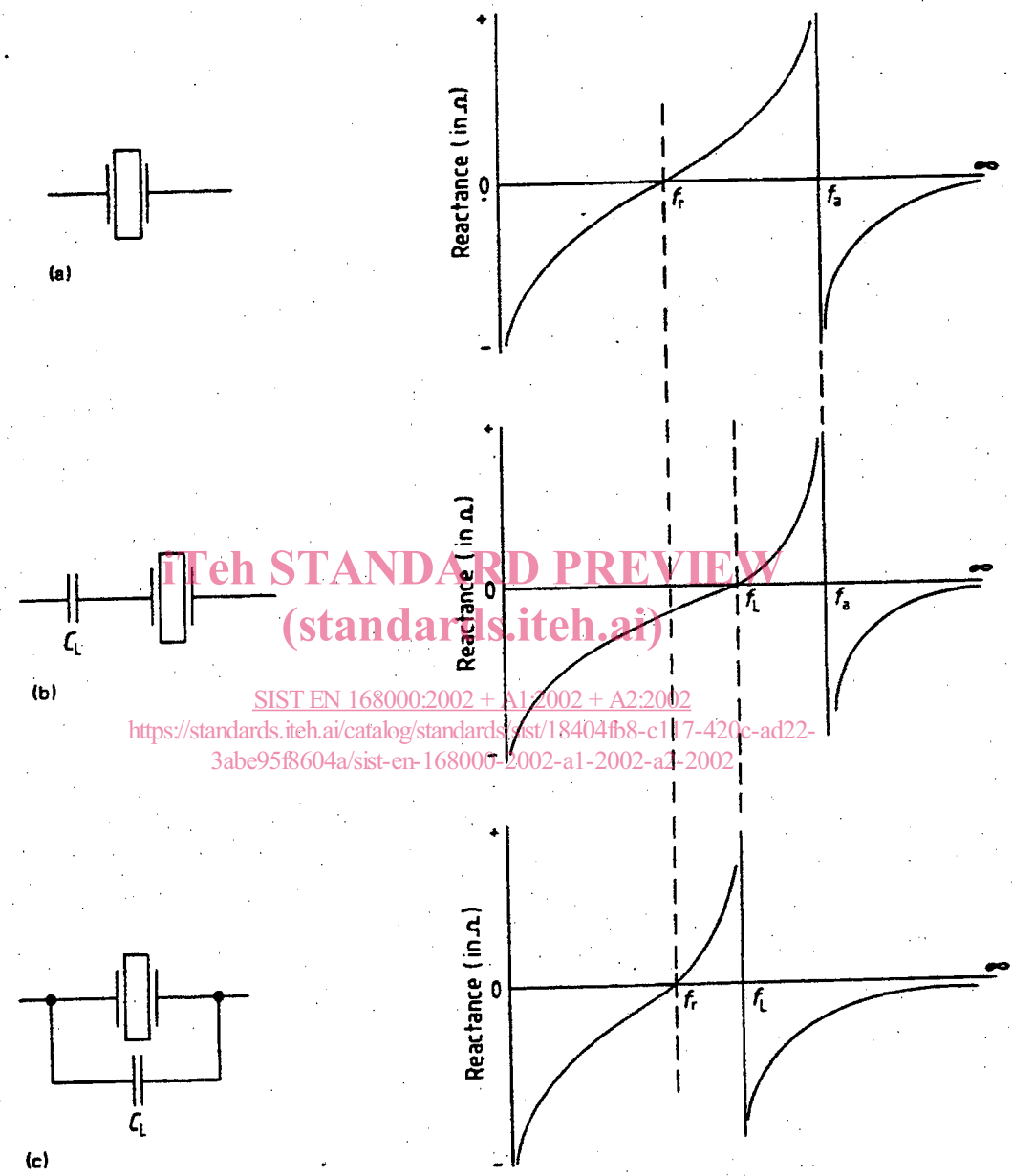
One of the two frequencies of a crystal unit in association with a series or with a parallel load capacitance, under specified conditions, at which the electrical impedance of the combination is resistive. The load resonance frequency is the lower of the two frequencies when the load capacitance is in series and the higher when it is in parallel (see Fig. 2).
For a given value of load capacitance (C_L), these frequencies are identical for all practical purposes and are given by the expression

$$\frac{1}{f} = 2\pi \sqrt{\left\{ \frac{L_1 \, C_1 \, (C_o + C_L)}{C_1 + C_o + C_L} \right\}}$$

Note 1 : The frequencies defined in 2.3.19, 2.3.21 and 2.3.23 are listed as being the terms more commonly used.
The frequencies associated with a quartz crystal are numerous and for a full explanation IEC 302 should be consulted.

Note 2 : When higher accuracies are required or secondary data (for

example, values of crystal unit motional parameters) are to be derived from the frequency measurements, IEC 302 and IEC 444-1 should be consulted.



Note 1. The values of load capacitances shown in (b) and (c) are equal.

Note 2. See 2.3.19, 2.3.21 and 2.3.23.

Figure 2. Resonance, anti-resonance and load resonance frequencies.