

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Piezoelectric filters of assessed quality –  
Part 1: Generic specification**

**Filtres piézoélectriques sous assurance de la qualité –  
Partie 1: Spécification générique**

IEC 60368-1:2000

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## PIEZOELECTRIC FILTERS OF ASSESSED QUALITY –

## Part 1: Generic specification

## FOREWORD

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**IEC 60368-1 edition 4.1 contains the fourth edition (2000) [documents 49/448/FDIS and 49/450/RVD] and its amendment 1 (2004) [documents 49/682/FDIS and 49/688/RVD].**

**A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.**

International Standard IEC 60368-1 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

International Standard IEC 60368-1 is the first part of a new edition of the IEC standard series for piezoelectric filters, updated to include the test requirements of the IECQ System.

The French version of the amendment has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

IEC 60368 consists of the following parts under the general title: Piezoelectric filters of assessed quality:

- Part 1: Generic specification (IEC 60368-1)
- Part 2: Guide to the use of piezoelectric filters –
  - Part 2-1: Quartz crystal filters (IEC 60368-2-1)
  - Part 2-2: Piezoelectric ceramic filters (IEC 60368-2-2)
- Part 3: Standard outlines (IEC 60368-3, under consideration)
- Part 4: Sectional specification – Capability approval (IEC 60368-4, to be published)
- Part 4-1: Blank detail specification – Capability approval (IEC 60368-4-1, to be published)
- ~~– Part 5: Sectional specification – Qualification approval (IEC 60368-5, under consideration)~~
- ~~– Part 5-1: Blank detail specification – Qualification approval (IEC 60368-5-1, under consideration)~~

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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# PIEZOELECTRIC FILTERS OF ASSESSED QUALITY –

## Part 1: Generic specification

### 1 General

#### 1.1 Scope

This part of IEC 60368 specifies the methods of test and general requirements for piezoelectric filters of assessed quality using either capability approval or qualification approval procedures.

#### 1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60368. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60368 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050(561):1991, *International Electrotechnical Vocabulary (IEV) – Chapter 561: Piezoelectric devices for frequency control and selection*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests - Tests B: Dry heat*

IEC 60068-2-3:1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-7:1983, *Environmental testing – Part 2: Tests – Test Ga and guidance: Acceleration, steady state*

IEC 60068-2-10:1988, *Environmental testing – Part 2: Tests – Test J and guidance: Mould growth*

IEC 60068-2-13:1983, *Environmental testing – Part 2: Tests – Test M: Low air pressure*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-17:1994, *Environmental testing – Part 2: Tests – Test Q: Sealing*

IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60068-2-29:1987, *Environmental testing – Part 2: Tests – Test Eb and guidance: Bump*



IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60068-2-32:1975, *Environmental testing – Part 2: Tests – Test Ed: Free fall (Procedure 1)*

IEC 60068-2-45:1980, *Environmental testing – Part 2: Tests – Test XA and guidance: Immersion in cleaning solvents*

IEC 60068-2-52:1996, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-58:1999, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60068-2-64:1993, *Environmental testing – Part 2: Test methods – Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60368-4, *Piezoelectric filters of assessed quality – Part 4: Sectional specification – Capability Approval* <sup>1)</sup>

IEC 60642:1979, *Piezoelectric ceramic resonators and resonator units for frequency control and selection – Chapter I: Standard values and conditions – Chapter II: Measuring and test conditions*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*. Basic EMC Publication Amendment 1 (1998) <sup>2)</sup>

IEC 61178-1:1993, *Quartz crystal units – A specification in the IEC Quality Assessment System for Electronic Components (IECQ) – Part 1: Generic specification*

IEC QC 001001:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IEC QC 001002-2:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 2: Documentation*

IEC QC 001002-3:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3: Approval Procedures*

ISO 1000:1992, *SI units and recommendations for use of their multiples and of certain other units*

### 1.3 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;
- any other international document (for example, of the IEC) to which reference is made.

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

<sup>1)</sup> To be published.

<sup>2)</sup> There is a consolidated edition 1.1 (1999) that includes IEC 61000-4-2 (1995) and its amendment 1 (1998).

## 2 Terminology and general requirements

### 2.1 General

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

- IEC 60027
- IEC 60050(561)
- IEC 60642
- IEC 61178-1
- ISO 1000

### 2.2 Definitions

For the purpose of this part of IEC 60368, the following definitions apply.

#### 2.2.1

##### **piezoelectric filter**

an electrical filter in which one or more piezoelectric resonators made from quartz crystals or other piezoelectric materials are incorporated

#### 2.2.2

##### **band-pass filter**

a filter having a single pass-band between two specified stop-bands  
[IEV 561-03-33]

#### 2.2.3

##### **band-stop filter**

a filter having a single stop-band between two specified pass-bands  
[IEV 561-03-34]

#### 2.2.4

##### **high-pass filter**

a filter having a single pass-band above a cut-off frequency and a stop-band for lower frequencies  
[IEV 561-03-32]

#### 2.2.5

##### **low-pass filter**

a filter having a single pass-band below a cut-off frequency and a stop-band for higher frequencies  
[IEV 561-03-31]

#### 2.2.6

##### **comb filter**

a two terminal pair filter in which there are five or more bands of which two or more are pass-bands and two or more are stop-bands  
[IEV 561-03-35]

#### 2.2.7

##### **monolithic filter**

a filter with at least one monolithic multiple pole resonator  
[IEV 561-03-36 modified]

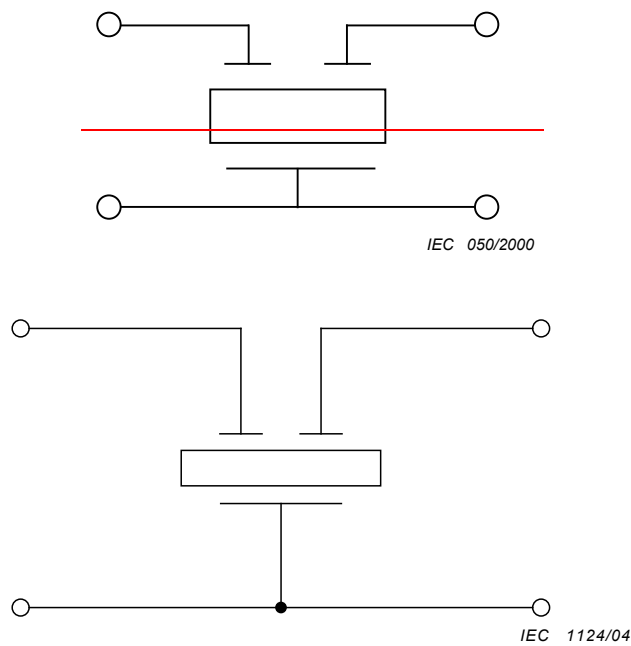


Figure 1 – Symbol of monolithic filter

### 2.2.8

#### tandem monolithic filter

a filter made by electrically connecting at least two monolithic multiple pole resonators

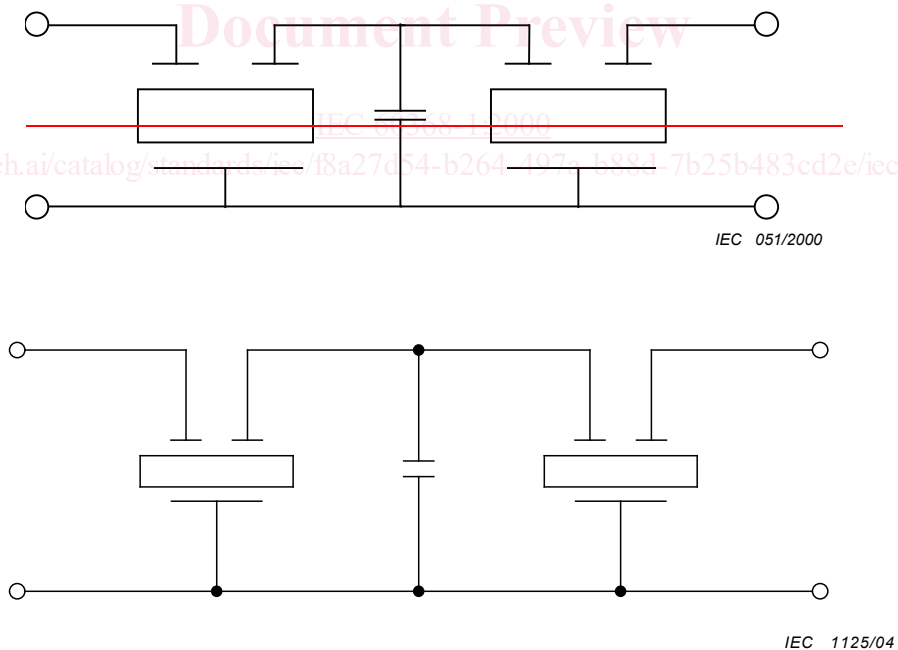


Figure 2 – Symbol of tandem monolithic filter

### 2.2.9

#### monolithic multiple pole resonator

a piezoelectric resonator with at least two mechanically coupled vibrating regions on a single crystal element

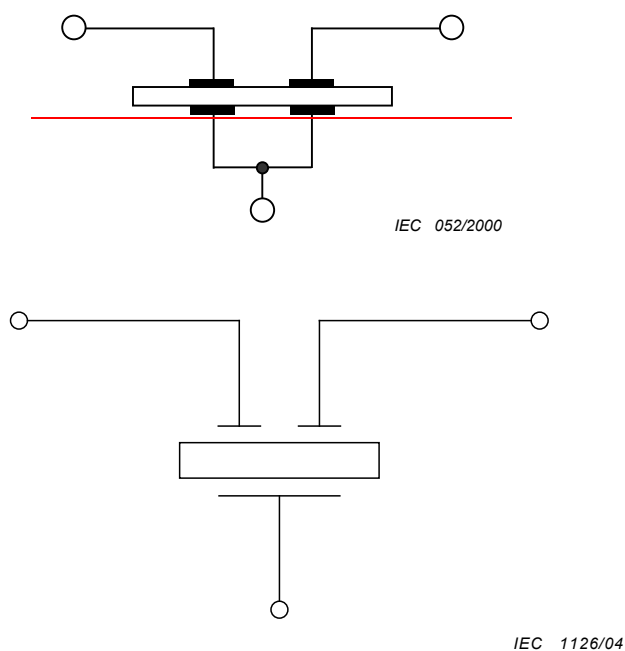


Figure 3 – Symbol of monolithic multiple pole resonator

**2.2.10  
input level**

the power, voltage or current value presented to the input terminal pair of a piezoelectric filter  
[IEV 561-03-02]

**2.2.11  
output level**

the power, voltage or current value delivered to the load circuit of a piezoelectric filter  
[IEV 561-03-03]

**2.2.12  
rated level**

the power, voltage or current value at which the characteristics of a piezoelectric filter are specified  
[IEV 561-03-04]

**2.2.13  
maximum level**

the power, voltage or current value above which unacceptable distortion of the signal or irreversible changes may occur in a piezoelectric filter  
[IEV 561-03-05]

**2.2.14  
available power**

the maximum power which may be obtained from a given source by suitable adjustment of the load impedance  
[IEV 561-03-06]

**2.2.15****input impedance**

the impedance presented by a piezoelectric filter to the signal source when terminated in the specified load impedance

[IEV 561-03-07]

**2.2.16****output impedance**

the impedance presented by a piezoelectric filter to the load when its input is connected to the specified source impedance

[IEV 561-03-08]

**2.2.17****terminating impedance**

the impedance presented to a piezoelectric filter by its load or by its source

[IEV 561-03-09]

**2.2.18****cut-off frequency**

a frequency of the pass-band at which the relative attenuation of a piezoelectric filter reaches a specified value

[IEV 561-03-10]

**2.2.19****mid-band frequency** (of a band-pass or band-stop filter)

the geometric mean of the cut-off frequencies limiting a single pass-band or single stop-band

NOTE In practice, the arithmetic mean is often used as a good approximation to the geometric mean for piezoelectric filters with relatively narrow pass-bands or stop-bands.

[IEV 561-03-11]

**2.2.20****nominal frequency** (of a piezoelectric filter)

the frequency used to identify the piezoelectric filter

[IEV 561-03-12]

**2.2.21****pass-band**

a band of frequencies in which the relative attenuation of a piezoelectric filter is equal to or less than a specified value

[IEV 561-03-13]

**2.2.22****pass bandwidth**

the separation of frequencies between which the attenuation of a piezoelectric filter shall be equal to or less than a specified value

[IEV 561-03-14]

**2.2.23****stop band**

a band of frequencies in which the relative attenuation of a piezoelectric filter is equal to or greater than specified values

[IEV 561-03-15]

**2.2.24**

**stop bandwidth**

the separation of frequencies between which the relative attenuation of a piezoelectric filter shall be equal to or greater than a specified value

[IEV 561-03-16]

**2.2.25**

**transition band**

a band of frequencies between a cut-off frequency and the nearest point of the adjacent stop-band

[IEV 561-03-17]

**2.2.26**

**envelope delay time**

the time of propagation of a certain characteristic of a signal envelope between two points, for a certain frequency

[IEV 561-03-18]

**2.2.27**

**phase delay time**

the time of propagation of a sinusoidal oscillation of a certain frequency between two points

[IEV 561-03-19]

**2.2.28**

**group delay**

the time equal to the first derivative of the phase shift, in radians, with respect to the angular frequency

~~2.2.28~~ **2.2.29**

**transducer attenuation** (of a filter)

the ratio, generally expressed in decibels, of the available power of a given source to the power that the filter connected to this source delivers to a load impedance under specified conditions

[IEV 561-03-20]

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