# INTERNATIONAL STANDARD

# IEC 60679-1

Third edition
2007-04

## Quartz crystal controlled oscillators of assessed quality –

## Part 1: Generic specification



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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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# CONTENTS

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# QUARTZ CRYSTAL CONTROLLED OSCILLATORS OF ASSESSED QUALITY –

## Part 1: Generic specification

## FOREWORD

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International Standard IEC 60679-1 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

This third edition cancels and replaces the second edition published in 1997 and its Amendments 1 (2002) and 2 (2003) and constitutes a technical revision. It represents a step in a revision of all parts of the IEC 60679 series to include the test requirements of the IECQ system. This edition is based on the relevant standards of that system.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 49/769/FDIS | 49/776/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

A list of all parts of the IEC 60679 series, published under the general title *Quartz crystal controlled oscillators of assessed quality,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

# QUARTZ CRYSTAL CONTROLLED OSCILLATORS OF ASSESSED QUALITY –

## Part 1: Generic specification

## 1 Scope

This part of IEC 60679 specifies the methods of test and general requirements for quartz crystal controlled oscillators of assessed quality using either capability approval or qualification approval procedures.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*
Amendment 1 (1992)

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

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

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

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

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

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

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

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

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

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

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

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

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

IEC 60068-2-32, *Environmental testing – Part 2: Tests – Test Ed: Free fall*

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

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

IEC 60068-2-58, *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, *Environmental testing – Part 2: Test methods – Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60469-1:1987, *Pulse techniques and apparatus – Part 1: Pulse terms and definitions*

IEC 60617-DB: 2001[1], *Graphical symbols for diagrams*

IEC 60679-5, *Quartz crystal controlled oscillators of assessed quality – Part 5: Sectional specification – Qualification approval*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test*

IECQ 01, *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, *SI units and recommendations for the use of their multiples and of certain other units*

ITU-T G.810, *Definitions and terminology for synchronization networks*

ITU-T G.811: *Timing characteristics of primary reference clocks*

ITU-T G.812, *Timing requirements of slave clocks suitable for use as node clocks in synchronization networks*

ITU-T G.813, *Timing characteristics of SDH equipment slave clocks (SEC)*

ITU-T G.825, *The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)*

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[1] "DB" refers to the IEC on-line database.

ANSI T1.101, *Synchronization Interface Standard*

ANSI T1.105.03, *Synchronous Optical Network (SONET) – Jitter and Wander at Network Equipment Interfaces*

ETSI EN 300 462 (all parts), *Transmission and Multiplexing (TM); Generic requirements for synchronization networks*

Telcordia GR-253, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*

- **Order of precedence**

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

– detail specification;
– sectional specification;
– generic specification;
– 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.



## 3 Terms, definitions and general information

### 3.1 General

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

IEC 60027
IEC 60050-561
IEC 60469-1
IEC 60617
ISO 1000

### 3.2 Definitions

For the purposes of this document, the following definitions apply.

**3.2.1**
**simple packaged crystal oscillator**
**SPXO**
crystal controlled oscillator having no means of temperature control or compensation, exhibiting a frequency/temperature characteristic determined substantially by the piezoelectric resonator employed

[IEV 561-04-01]

**3.2.2**
**overtone crystal controlled oscillator**
oscillator designed to operate with the controlling piezoelectric resonator functioning in a specified mechanical overtone order of vibration

[IEV 561-04-02]

**3.2.3**
**crystal cut**
orientation of the crystal element with respect to the crystallographic axes of the crystal

NOTE This definition is included as it may be desirable to specify the cut (and hence the general form of the frequency/temperature performance) of a crystal unit used in an oscillator application. The choice of the crystal cut will imply certain attributes of the oscillator which may not otherwise appear in the detail specification.

**3.2.4**
**voltage controlled crystal oscillator**
**VCXO**
crystal controlled oscillator, the frequency of which can be deviated or modulated according to a specified relation, by application of a control voltage

[IEV 561-04-03]

**3.2.5**
**temperature compensated crystal oscillator**
**TCXO**
crystal controlled oscillator whose frequency deviation due to temperature is reduced by means of a compensation system, incorporated in the device

[IEV 561-04-04]

**3.2.6**
**oven controlled crystal oscillator**
**OCXO**
crystal controlled oscillator in which at least the piezoelectric resonator is temperature controlled

[IEV 561-04-05]

NOTE This mode of operation ensures that the oscillator frequency will remain sensibly constant over the operating temperature range of the OCXO, therefore independent of the frequency/temperature characteristic of the crystal unit.



**3.2.7**
**nominal frequency**
frequency used to identify the crystal controlled oscillator

[IEV 561-04-06]

**3.2.8**
**frequency tolerance**
maximum permissible deviation of the oscillator frequency from a specified nominal value when operating under specified conditions

[IEV 561-04-07]

NOTE Frequency tolerances are often assigned separately to specified ambient effects, namely electrical, mechanical and environmental. When this approach is used, it is necessary to define the values of other operating parameters as well as the range of the specified variable, that is to say:

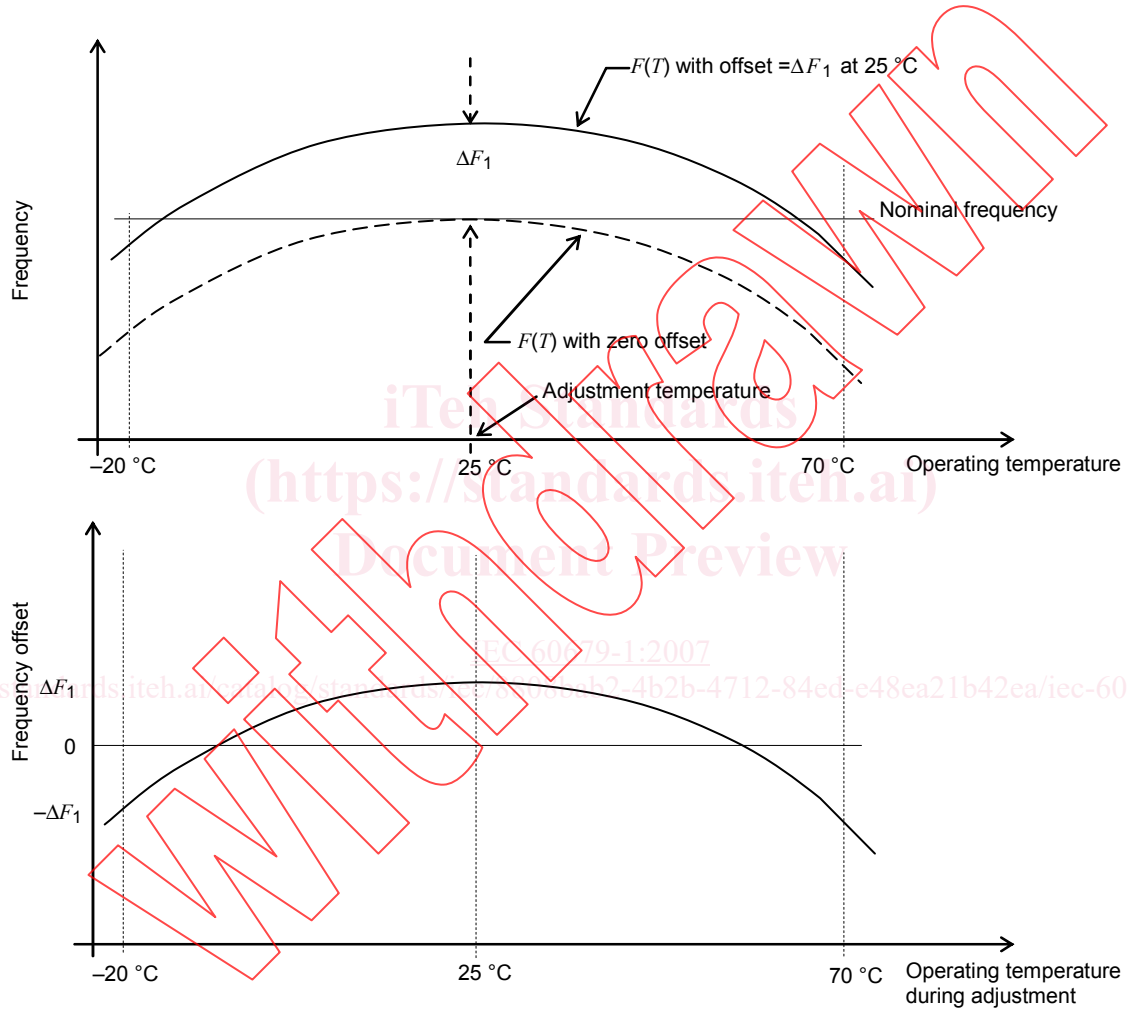
– deviation from the frequency at the specified reference temperature due to operation over the specified temperature range, other conditions remaining constant;
– deviation from the frequency at the specified supply voltage due to supply voltage changes over the specified range, other conditions remaining constant;
– deviation from the initial frequency due to ageing, other conditions remaining constant;
– deviation from the frequency with specified load conditions due to changes in load impedance over the specified range, other conditions remaining constant.

In some cases, an overall frequency tolerance may be specified, due to any/all combinations of operating parameters, during a specified lifetime.

**3.2.9**
**frequency offset**
frequency difference, positive or negative, which should be added to the specified nominal frequency of the oscillator, when adjusting the oscillator frequency under a particular set of operating conditions in order to minimize its deviation from nominal frequency over the specified range of operating conditions

[IEV 561-04-08]

EXAMPLE In order to minimize the frequency deviation from nominal over the entire temperature range, a frequency offset may be specified for adjustment at the reference temperature (see Figure 1).




IEC 445/07

**Figure 1 – Example of the use of frequency offset**

**3.2.10**
**adjustment frequency**
frequency to which an oscillator must be adjusted, under a particular combination of operating conditions, in order to meet the frequency tolerance specification over the specified range of operating conditions, i.e. adjustment frequency = nominal frequency + frequency offset

[IEV 561-04-09]

**3.2.11**
**frequency adjustment range**
range over which the oscillator frequency may be varied by means of some variable element, for the purpose of:

a) setting the frequency to a particular value, or

b) to correct the oscillator frequency to a prescribed value after deviation due to ageing, or other changed conditions.

[IEV 561-04-10]

**3.2.12**
**storage temperature range**
minimum and maximum temperatures as measured on the enclosure at which the crystal controlled oscillator may be stored without deterioration or damage to its performance

**3.2.13**
**operating temperature range**
range of temperature over which the oscillator will function, maintaining frequency and other output signal characteristics within specified tolerances

[IEV 561-04-11]

**3.2.14**
**operable temperature range**
range of temperature over which the oscillator will continue to provide an output signal, though not necessarily within the specified tolerances of frequency, level, waveform, etc.

[IEV 561-04-12]

**3.2.15**
**reference temperature**
temperature at which certain oscillator performance parameters are measured, normally 25 °C ± 2 °C

**3.2.16**
**reference point temperature**
temperature measured at a specific reference point relative to the oscillator

**3.2.17**
**thermal transient frequency stability**
oscillator frequency time response when ambient temperature is changed from one specific temperature to another with a specific rate

**3.2.18**
**stabilization time**
time, measured from the initial application of power, required for a crystal controlled oscillator to stabilize its operation within specified limits

[IEV 561-04-13]

**3.2.19**
**frequency/voltage coefficient**
fractional change in output frequency resulting from an incremental change in supply voltage, other parameters remaining unchanged

[IEV 561-04-14]

NOTE In the case of OCXOs, a considerable time may elapse before the full effect of a supply voltage change is observed, as the temperature of the oven may drift gradually to a new value following the voltage perturbation.

**3.2.20**
**frequency/load coefficient**
fractional change in output frequency resulting from an incremental change in electrical load impedance, other parameters remaining unchanged