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Part 1: Generic specifications

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



49/1472/CD

COMMITTEE DRAFT (CD)

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SECRETARIAT:

Japan

SECRETARY:

Mr Masanobu Okazaki

OF INTEREST TO THE FOLLOWING COMMITTEES:

SC 47E

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

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TITLE:

Piezoelectric sensors - Part 1: Generic specifications

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PIEZOELECTRIC SENSORS - PART 1: GENERIC SPECIFICATIONS –

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IEC 63041–1 has been prepared by subcommittee 13: Sensor devices and systems, of IEC technical committee 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection. It is an International Standard.

The third edition cancels and replaces the second edition published 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Based on IEC TS 61994-5:2023, a definition of the term "SOURCE" has been added.

The text of this International Standard is based on the following documents:

Draft	Report on voting
49/XX/FDIS	49/XX/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 63041 series, published under the general title *Piezoelectric sensors*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

Further reading:

IEC 60068 (all parts), Environmental testing

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

IEC 60679 (all parts), Piezoelectric, dielectric and electrostatic oscillators of assessed quality

IEC 60689, Measurements and test methods for tuning fork quartz crystal units in the range from 10 kHz to 200 kHz and standard values

IEC 60758:2016, Synthetic quartz crystal – Specifications and guidelines for use

IEC 61240:2016, Piezoelectric devices – Preparation of outline drawings of surface-mounted devices (SMD) for frequency control and selection – General rules

IEC 61760 (all parts), Surface mounting technology

IEC 61837 (all parts), Surface mounted piezoelectric devices for frequency control and selection – Standard outlines and terminal lead connections

IEC TS 61994 (all parts), Piezoelectric and dielectric devices for frequency control and selection – Glossary

IEC 62276:2016, Single crystal wafers for surface acoustic wave (SAW) device applications – Specifications and measuring methods

IEC 63041-2, Piezoelectric sensors – Part 2: Chemical and biochemical sensors

A. Benjaminson and S. Stallings, A Microcomputer-Compensated Crystal Oscillator Using Dual-Mode Resonator, Proc. 43rd Annual Symposium on Frequency Control, pp. 20-26, 1989.

J. R. Vig, Dual-mode Oscillators for Clocks and Sensors, Proc. 1999 IEEE International Ultrasonics Symposium

N. Matsumoto, Y. Sudo, B. Sinha and M. Niwa, Long-term stability and performance characteristics of crystal gauge at high pressures and temperatures, Proc. 1999 IEEE International Frequency Control Symposium

PIEZOELECTRIC SENSORS - PART 1: GENERIC SPECIFICATIONS –

1 Scope

This part of IEC 63041 applies to piezoelectric sensors of resonator, delay-line and non-acoustic types, which are used in physical and engineering sciences, chemistry and biochemistry, medical and environmental sciences, etc.

The purpose of this document is to specify the terms and definitions for piezoelectric sensors, and to make sure from a technological perspective that users understand the state-of-art piezoelectric sensors and how to use them correctly.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050–561, *International Electrotechnical Vocabulary – Part 561: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection*

IEC 60122–2–1, *Quartz crystal units for frequency control and selection – Part 2: Guide to the use of quartz crystal units for frequency control and selection – Section One: Quartz crystals for microprocessor clock supply*

IEC 60444–9, *Measurement of quartz crystal unit parameters – Part 9: Measurement of spurious resonances of piezoelectric crystal units*

IEC 60617, *Graphical symbols for diagrams*, available at <https://std.iec.ch/iec60617>

IEC 63041–3:2020, *Piezoelectric sensors – Part 3: Physical sensors*

ISO 2859–1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 80000–1, *Quantities and units – Part 1: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60027, IEC 60050–561, IEC 60617, ISO 80000–1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

NOTE Piezoelectric sensors covered herein are those used for the detection and measurement of physical quantities, chemical substances or biological molecules.

3.1 Piezoelectric sensors

3.1.1

piezoelectric sensor element

electronic component which is able to detect physical quantities as a change in its frequency, phase, delay, electrical charge, resistance, Q-value, bandwidth, etc.

Note 1 to entry: For chemical and biochemical sensor applications, the piezoelectric sensor element includes a sensitive or receptive layer (target recognition material).

3.1.2

resonator type sensor element

piezoelectric sensor component using acoustic resonances

[SOURCE: IEC TS 61994-5:2023, 3.26]

3.1.3

delay-line type sensor element

piezoelectric sensor component using a delay-line of surface acoustic wave (SAW) transversal filter type

[SOURCE: IEC TS 61994-5:2023, 3.1]

3.1.4

quasi-static piezoelectric sensor element

piezoelectric sensor component using the electrical charge induced by a quasi-static force, torque, or the like

[SOURCE: IEC TS 61994-5:2023, 3.25]

3.1.5

non-acoustic type sensor element

piezoelectric sensor component using the electrical charge induced by a quasi-static force, torque or the like

Note 1 to entry: Here, the term, "non-acoustic", represents "quasi-static piezoelectric". Accordingly, the (piezoelectric) non-acoustic type sensor element means a sensor element using the quasi-static piezoelectric effect.

3.1.6

piezoelectric sensor cell

sensor element equipped with necessary mechanical accessories and attachments to correctly detect the parameters to be measured

[SOURCE: IEC TS 61994-5:2023, 3.15]

3.1.7

piezoelectric sensor module

sensor element or cell equipped with electronic accessories for interfacing to external data acquisitions

[SOURCE: IEC TS 61994-5:2023, 3.17]

3.1.8

piezoelectric sensor system

organized system including detection, amplification of detected value, communication with other equipment and analysis of detected value

Note 1 to entry: Here, these functions cooperate mutually.

[SOURCE: IEC TS 61994-5:2023, 3.18]

3.1.9

piezoelectric sensor

generic term that includes a sensor element, cell, module and system

[SOURCE: IEC TS 61994-5:2023, 3.14]

3.1.10

QCM

quartz crystal microbalance

piezoelectric sensor element for detecting small mass change using quartz crystal resonators

Note 1 to entry: A thickness shear mode (TSM) sensor is identical with a QCM.

Note 2 to entry: Some sensor elements include asymmetric electrode type film-thickness sensors, in which the areas of the front and back electrodes are different. This specification should be clearly defined by the contract specifications or individual specifications concluded between the manufacturer and the customer.

[SOURCE: IEC TS 61994-5:2023, 3.24]

3.2 Types of chemical sensors

3.2.1

piezoelectric chemical sensor element

piezoelectric sensor component including a sensitive layer (target recognition material), which is necessary for the practical measurement of simple non-biological molecules in quantity, and which works and detects chemical substances mainly in the gas phase

Note 1 to entry: The sensitive layer is usually formed as a thin film of a target recognition material on the surface of the piezoelectric sensor element and is often called a target recognition material.

Note 2 to entry: A gas sensor element is one of the chemical sensor elements.

[SOURCE: IEC TS 61994-5:2023, 3.9]

3.2.2

piezoelectric biochemical sensor element

piezoelectric sensor component including a receptive layer (target recognition material), which is necessary for the practical measurement of complex biological molecules in quantity, and which works mainly in aqueous media and detects biomolecules therein

Note 1 to entry: The receptive layer is usually formed as a thin film of a target recognition material on the surface of the piezoelectric sensor element and is often called a target recognition material.

[SOURCE: IEC TS 61994-5:2023, 3.8]

3.3 Types of physical sensors

3.3.1

piezoelectric force sensor element

piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for force measurement

EXAMPLE Inertial measurement system

[SOURCE: IEC TS 61994-5:2023, 3.11]

3.3.2

piezoelectric pressure sensor element

piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for pressure measurement

Note 1 to entry: Oil pressure measuring device and flow-meter

[SOURCE: IEC TS 61994-5:2023, 3.13]

3.3.3

piezoelectric torque sensor element

piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for torque measurement

[SOURCE: IEC TS 61994-5:2023, 3.21]

3.3.4

piezoelectric viscosity sensor element

piezoelectric sensor component whose resonance frequency, delay or insertion loss/gain is used for viscosity measurement

EXAMPLE Hydrogen leak-detector for fuel-cell

[SOURCE: IEC TS 61994-5:2023, 3.23]