BS EN IEC 62127-3:2022



BSI Standards Publication

Ultrasonics — Hydrophones

Part 3: Properties of hydrophones for ultrasonic fields

bsi.

National foreword

This British Standard is the UK implementation of EN IEC 62127-3:2023. It is identical to IEC 62127-3:2022. It supersedes BS EN 62127-3:2007+A1:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/87, Ultrasonics.

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English Version

Ultrasonics - Hydrophones - Part 3: Properties of hydrophones for ultrasonic fields (IEC 62127-3:2022)

Ultrasons - Hydrophones - Partie 3: Propriétés des hydrophones pour les champs ultrasoniques (IEC 62127-3:2022)

Ultraschall - Hydrophone - Teil 3: Eigenschaften von Hydrophonen zur Verwendung in Ultraschallfeldern (IEC 62127-3:2022)

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European foreword

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The following dates are fixed:

•	latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop) 2023-10-23
•	latest date by which the national standards conflicting with the document have to be withdrawn	(dow) 2026-01-23

This document supersedes EN 62127-3:2007 and all of its amendments and corrigenda (if any).

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In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60565-1 NOTE Approved as EN IEC 60565-1

IEC 60565-2 NOTE Approved as EN IEC 60565-2

Annex A
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 62127-1	-	Ultrasonics - Hydrophones - Part 1: Measurement and characterization of medical ultrasonic fields	EN IEC 62127-1	-
IEC 62127-2	-	Ultrasonics - Hydrophones - Part 2: Calibration for ultrasonic fields up to 40 MHz	EN 62127-2	-

IEC 62127-3

Edition 2.0 2022-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Ultrasonics – Hydrophones – Part 3: Properties of hydrophones for ultrasonic fields

Ultrasons – Hydrophones – Partie 3: Propriétés des hydrophones pour les champs ultrasoniques

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ULTRASONICS – HYDROPHONES –

Part 3: Properties of hydrophones for ultrasonic fields

FOREWORD

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IEC 62127-3 has been prepared by IEC technical committee 87: Ultrasonics. It is an International Standard.

This second edition cancels and replaces the first edition published in 2007 and Amendment 1:2013. This edition constitutes a technical revision.

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

a) The upper frequency limit of 40 MHz has been removed.
b) Hydrophone sensitivity definitions have been changed to recognize sensitivities as complex-valued quantities.
c) Procedures to determine the effective hydrophone size have been changed according to the rationale outlined in Annex B.
d) Requirements on the frequencies for which the effective hydrophone size shall be provided have been changed to achieve practicality for increased frequency bands.
e) The new Annex B and Annex C have been added.

f) Annex A has been updated to reflect the changes of the normative parts.

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

Draft	Report on voting
87/818/FDIS	87/824/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/publications.

A list of all parts of IEC 62127 series, published under the general title *Ultrasonics – Hydrophones,* can be found on the IEC website.

NOTE Words in **bold** in the text are defined in Clause 3.

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,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The spatial and temporal distribution of acoustic pressure in an ultrasonic field in a liquid medium is commonly determined using miniature ultrasonic **hydrophones**. The properties of these **hydrophones** have been dealt with in a number of IEC standards in various aspects. The purpose of this document is to bring together all these specifications and to establish a common standard on the properties of ultrasonic **hydrophones**. The main **hydrophone** application in this context is the measurement of ultrasonic fields emitted by medical diagnostic equipment in water. Other medical applications are field measurements for therapy equipment such as that used in lithotripsy, high-intensity focused ultrasound (HIFU) and physiotherapy. **Hydrophones** are also used extensively in non-medical applications for both product development and quality control including:

– mapping of the ultrasound field within ultrasonic cleaning baths;

– characterization of acoustic fields used in transmission measurement systems (e.g. ultrasonic spectrometers, ultrasonic attenuation meters and velocimeters);

– characterization of acoustic fields used in reflection measurement systems (e.g. Doppler flowmeters).

While the term **hydrophone** can be used in a wider sense, it is understood here as referring to miniature piezoelectric **hydrophones**. It is this instrument type that is used today in various areas of ultrasonics and, in particular, to quantitatively characterize the field structure of medical diagnostic instruments. With regard to other pressure sensor types, such as those based on fibre optics, some of the requirements of this document are applicable to these as well but others are not. If in the future these other **hydrophone** types gain more importance in field measurement practice, their properties will have to be dealt with in a revised version of this document or in a separate one.

Underwater **hydrophones** as covered by IEC 60500, IEC 60565-1, and IEC 60565-2 are not included in this document, although there is an overlap in the frequency ranges. Underwater **hydrophones** are used in natural waters, even in the ocean, and this leads to different technical concepts and requirements. In addition, the main direction of acoustic incidence in underwater applications is at various angles and often at right angles to the **hydrophone axis**, whereas in this document it is assumed that the main direction of acoustic incidence is in the direction of the **hydrophone axis**.

Historically, ultrasonic **hydrophones** were used almost exclusively as amplitude sensors. However, the complex-valued nature of a **hydrophone's** system response function is well understood and IEC 62127-1:2022 makes use of this within the deconvolution procedures it contains. In this document, requirements are specified for the amplitude aspect of the **hydrophone** sensitivity and recommendations are provided for the phase aspect which can be derived either via calibration, or via calculation methods that are discussed in IEC 62127-1:2022.

ULTRASONICS – HYDROPHONES –

Part 3: Properties of hydrophones for ultrasonic fields

1 Scope

This part of IEC 62127 specifies relevant **hydrophone** characteristics.

This document is applicable to:

– **hydrophones** employing piezoelectric sensor elements, designed to measure the pulsed and continuous wave ultrasonic fields generated by ultrasonic equipment;

– **hydrophones** used for measurements made in water;

– **hydrophones** with or without an associated pre-amplifier.

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 62127-1, *Ultrasonics – Hydrophones – Part 1: Measurement and characterization of medical ultrasonic fields*

IEC 62127-2, *Ultrasonics – Hydrophones – Part 2: Calibration for ultrasonic fields up to 40 MHz*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in IEC 62127-1, IEC 62127-2 and the following apply.

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

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

3.1
acoustic pulse waveform
temporal waveform of the **instantaneous acoustic pressure** at a specified position in an acoustic field and displayed over a period sufficiently long to include all significant acoustic information in a single pulse or tone-burst, or one or more cycles in a continuous wave

Note 1 to entry: Temporal waveform is a representation (e.g. oscilloscope presentation or formula) of the **instantaneous acoustic pressure**.

[SOURCE: IEC 62127-1:2022, 3.1]