

INTERNATIONAL STANDARD

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

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





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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and symbols.....	7
4 List of symbols	11
5 Hydrophone characteristics	11
5.1 General.....	11
5.2 Basic information	11
5.3 Sensitivity	12
5.4 Frequency response	13
5.4.1 Stated frequency band.....	13
5.4.2 Frequency dependence	13
5.5 Directional response	13
5.5.1 General	13
5.5.2 Determination of the directional response	13
5.5.3 Symmetry of directional response	14
5.6 Effective hydrophone size	15
5.6.1 General	15
5.6.2 Model of directional response	15
5.6.3 Fitting of experimental response to theoretical predictions	16
5.7 Dynamic range, linearity and electromagnetic interference.....	16
5.8 Electric output characteristics	17
5.8.1 Hydrophone without pre-amplifier	17
5.8.2 Hydrophone assembly	18
5.8.3 Output lead configuration.....	18
5.9 Environmental aspects.....	18
5.9.1 Temperature range	18
5.9.2 Water tightness	18
5.9.3 Water properties and incompatible materials	18
5.9.4 Exposed material.....	18
5.10 Guidance manual.....	19
5.11 List of hydrophone characteristics.....	19
Annex A (informative) Examples of information on hydrophone properties	20
A.1 General.....	20
A.2 Basic information	20
A.3 Sensitivity and frequency response.....	20
A.4 Directional response	23
A.5 Effective dimension.....	23
A.6 Dynamic range, linearity and electromagnetic interference.....	25
A.6.1 Lower dynamic limit	25
A.6.2 Upper dynamic limit	25
A.7 Electric output characteristics	25
A.8 Environmental aspects.....	25
Annex B (informative) Rationale.....	27

B.1	General.....	27
B.2	Changes to the determination of directional response	27
B.3	Changes to the determination of effective radius.....	27
Annex C (informative) Membrane hydrophone directivity model		29
C.1	General.....	29
C.2	Details of model.....	29
Bibliography.....		30
Figure A.1 – Frequency response of 0,2 mm needle hydrophone in the range 1 MHz to 40 MHz		21
Figure A.2 – Frequency response of 0,2 mm needle hydrophone in the range 100 kHz to 1 MHz		22
Figure A.3 – Directional response of 0,2 mm needle hydrophone		23
Figure A.4 – Effective radius of 0,2 mm needle hydrophone		24
Figure A.5 – Comparison of modelled and experimentally derived directional response		24
Table A.1 – Example of basic information for 0,2 mm needle hydrophone assembly		20

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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.

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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.