

INTERNATIONAL STANDARD

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

**Ultrasons – Hydrophones –
Partie 1: Mesurage et caractérisation des champs ultrasoniques médicaux**





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ULTRASONICS – HYDROPHONES –

Part 1: Measurement and characterization of medical ultrasonic fields

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IEC 62127-1 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 and requirements for narrow-band approximation and broadband measurements have been modified; details on waveform deconvolution have been added.
- d) Procedures for spatial averaging correction have been amended.
- e) Annex D, Annex E and bibliography have been updated to support the changes of the normative parts.

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

Draft	Report on voting
87/783/FDIS	87/788/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 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 terms defined in Clause 3.

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- withdrawn,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

INTRODUCTION

The main purpose of this document is to define various acoustic parameters that can be used to specify and characterize ultrasonic fields propagating in liquids, and, in particular, water, using hydrophones. Measurement procedures are outlined that may be used to determine these parameters. Specific device related measurement standards, for example IEC 61689, IEC 61157, IEC 61847 or IEC 62359, can refer to this document for appropriate acoustic parameters. In IEC 62359, some additional measurement methods for attenuated parameters and indices are described addressing the specific needs of acoustic output characterization of ultrasonic diagnostic equipment in accordance with IEC 60601-2-37.

The philosophy behind this document is the specification of the acoustic field in terms of acoustic pressure parameters, acoustic pressure being the primary measurement quantity when hydrophones are used to characterize the field.

Intensity parameters are specified in this document, but these are regarded as derived quantities that are meaningful only under certain assumptions related to the ultrasonic field being measured.

ULTRASONICS – HYDROPHONES –

Part 1: Measurement and characterization of medical ultrasonic fields

1 Scope

This part of IEC 62127 specifies methods of use of calibrated **hydrophones** for the measurement in liquids of acoustic fields generated by ultrasonic medical equipment including **bandwidth** criteria and calibration frequency range requirements in dependence on the spectral content of the fields to be characterized.

This document:

- defines a group of acoustic parameters that can be measured on a physically sound basis;
- defines a second group of parameters that can be derived under certain assumptions from these measurements, and called derived intensity parameters;
- defines a measurement procedure that can be used for the determination of acoustic pressure parameters;
- defines the conditions under which the measurements of acoustic parameters can be made using calibrated **hydrophones**;
- defines procedures for correcting for limitations caused by the use of **hydrophones** with finite **bandwidth** and finite active element size, and for estimating the corresponding **uncertainties**.

NOTE 1 Throughout this document, SI units are used. In the specification of certain parameters, such as **beam areas** and intensities, it can be convenient to use decimal multiples or submultiples. For example, **beam area** is likely to be specified in cm^2 and intensities in W/cm^2 or mW/cm^2 .

NOTE 2 The **hydrophone** as defined can be of a piezoelectric or an optic type.

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 60565-1, *Underwater acoustics – Hydrophones – Calibration of hydrophones – Part 1: Procedures for free-field calibration of hydrophones*

IEC 61689, *Ultrasonics – Physiotherapy systems – Field specifications and methods of measurement in the frequency range 0,5 MHz to 5 MHz*

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

IEC 62127-3, *Ultrasonics – Hydrophones – Part 3: Properties of hydrophones for ultrasonic fields up to 40 MHz*

IEC 63009, *Ultrasonics – Physiotherapy systems – Field specifications and methods of measurement in the frequency range 20 kHz to 500 kHz*

ISO 16269-6, *Statistical interpretation of data – Part 6: Determination of statistical tolerance intervals*