Ultrasonics - Hydrophones -- Part 3: Properties of hydrophones for ultrasonic fields up to 40 MHz

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EESTI STANDARDI EESSÕNA **NATIONAL FOREWORD**

Käesolev Eesti standard EVS-EN 62127-3:2007 sisaldab Euroopa standardi EN 62127-3:2007 ingliskeelset teksti. Käesolev dokument on jõustatud 23.11.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 62127-3:2007 consists of the English text of the European standard EN 62127-3:2007. This document is endorsed on 23.11.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: This International Standard 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; This International Standard specifies relevant hydrophone characteristics.	**Scope:** This International Standard 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; This International Standard specifies relevant hydrophone characteristics.

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Võtmesõnad:

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EN 62127-3

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Partially supersedes EN 61101:1993, EN 61102:1993 + A1:1994, EN 61220:1995 and EN 62092:2001

English version

Ultrasonics - Hydrophones - Part 3: Properties of hydrophones for ultrasonic fields up to 40 MHz

(IEC 62127-3:2007)

Ultrasons -
Hydrophones -
Partie 3: Propriétés des hydrophones pour les champs ultrasonores jusqu'à 40 Mhz
(CEI 62127-3:2007)

Ultraschall -
Hydrophone -
Teil 3: Eigenschaften von Hydrophonen zur Verwendung in Ultraschallfeldern bis zu 40 MHz
(IEC 62127-3:2007)

This European Standard was approved by CENELEC on 2007-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 62127-3:2007 E

Foreword

The text of document 87/354/CDV, future edition 1 of IEC 62127-3, prepared by IEC TC 87, Ultrasonics, was submitted to the IEC-CENELEC parallel Unique Acceptance Procedure and was approved by CENELEC as EN 62127-3 on 2007-09-01.

EN 62127-1, EN 62127-2 and EN 62127-3 are being published simultaneously. Together these European Standards cancel and replace EN 61101:1993, EN 61102:1993 + A1:1994, EN 61220:1995 and EN 62092:2001.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2008-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-09-01

Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 62127-3:2007 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60565 NOTE Harmonized as EN 60565:2007 (not modified).

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 62127-1	-[1)]	Ultrasonics - Hydrophones - Part 1: Measurement and characterization of medical ultrasonic fields up to 40 MHz	EN 62127-1	2007[2)]
IEC 62127-2	-[1)]	Ultrasonics - Hydrophones - Part 2: Calibration for ultrasonic fields up to 40 MHz	EN 62127-2	2007[2)]

[1)] Undated reference.

[2)] Valid edition at date of issue.

IEC 62127-3

Edition 1.0 2007-08

INTERNATIONAL STANDARD

Ultrasonics – Hydrophones –
Part 3: Properties of hydrophones for ultrasonic fields up to 40 MHz

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INTERNATIONAL STANDARD

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ULTRASONICS – HYDROPHONES –

Part 3: Properties of hydrophones for ultrasonic fields up to 40 MHz

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62127-3 has been prepared by IEC technical committee 87: Ultrasonics

IEC 62127-1, IEC 62127-2 and IEC 62127-3 are being published simultaneously. Together these cancel and replace IEC 60866:1987, IEC 61101:1991, IEC 61102:1991, IEC 61220:1993 and IEC 62092:2001.

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

Enquiry draft	Report on voting
87/354/CDV	87/373/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 publication will remain unchanged until the maintenance result date indicated on the IEC website 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.

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 part of IEC 62127 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 standard 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 standard or in a separate one.

Underwater **hydrophones** as covered by IEC 60500 and IEC 60565 are not included in this standard, 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 typically at right angles to the **hydrophone axis**, whereas it is assumed in this standard that it is in the direction of the **hydrophone axis**.

In the past, ultrasonic **hydrophones** have been applied almost exclusively as amplitude sensors. At present a change can be seen and it is increasingly considered useful to have additional phase information, which, however, is only possible if the phase characteristics of the **hydrophone** have been determined during calibration. In this standard, therefore, requirements are specified for the amplitude aspect of the **hydrophone** sensitivity, and recommendations are provided for the phase aspect, as an option to be considered.

ULTRASONICS – HYDROPHONES –

Part 3: Properties of hydrophones for ultrasonic fields up to 40 MHz

1 Scope

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

This standard 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 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 62127-1, *Ultrasonics – Hydrophones – Part 1: Measurement and characterization of medical ultrasonic fields up to 40 MHz*

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.

3.1
directional response
description, generally presented graphically, of the response of a **hydrophone**, as a function of direction of propagation of the incident plane sound wave, in a specified plane through the **reference centre** and at a specified frequency

NOTE Definition adopted from IEC 60565:2006.

3.2
effective hydrophone radius
***a*h, *a*h3, *a*h6**

radius of a stiff disc receiver **hydrophone** that has a predicted **directional response** function with an angular width equal to the observed angular width

NOTE 1 The angular width is determined at a specified level below the peak of the **directional response** function. For the specified levels of 3 dB and 6 dB, the radii are denoted by a_{h3} and a_{h6} respectively.

NOTE 2 The radius is usually the function of frequency. For representative experimental data, see [1].

NOTE 3 The **effective hydrophone radius** is expressed in metres (m).