



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 62127-2:2024**  
**01-februar-2024**

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**Ultrazvok - Hidrofoni - 2. del: Kalibracija za ultrazvočna polja**

Ultrasonics - Hydrophones - Part 2: Calibration for ultrasonic fields

Ultrasons - Hydrophones - Partie 2: Etalonnage des champs ultrasoniques

**Ta slovenski standard je istoveten z: prEN IEC 62127-2:2023**

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17.140.50 Elektroakustika Electroacoustics

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PROPOSED HORIZONTAL STANDARD:

Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

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TITLE:

**Ultrasonics – Hydrophones – Part 2: Calibration for ultrasonic fields**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ULTRASONICS – HYDROPHONES –

## Part 2: Calibration for ultrasonic fields

## FOREWORD

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- 290 International Standard IEC 62127-2 has been prepared by IEC technical committee 87:  
291 Ultrasonics.
- 292 First editions of IEC 62127-1, IEC 62127-2 and IEC 62127-3 were published simultaneously.
- 293 This second edition cancels and replaces the first edition published in 2007-08, its amendment  
294 1 (2013-02) and its amendment 2 (2017-03). This edition constitutes a technical revision.
- 295 This edition includes the following significant technical changes with respect to the previous  
296 edition:
- 297 a) The upper frequency limit of 40 MHz has been removed;
- 298 b) Hydrophone sensitivity definitions have been changed to recognize sensitivities as  
299 complex-valued quantities;

- 300 c) Directional response measurement and effective size determination procedures have been  
301 updated in clause 12.5.1 to comply with recent changes in IEC 62127-3;
- 302 d) Annex F has been amended to comprise a calibration technique for high frequency  
303 complex-valued calibration;
- 304 e) The reciprocity method description in Annex K was extended to also comprise focusing  
305 transducers;
- 306 f) The bibliography has been corrected and updated to support the changes of the normative  
307 parts.

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

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

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

312

313 The committee has decided that the contents of the base publication and its amendments will  
314 remain unchanged until the stability date indicated on the IEC web site under  
315 "http://webstore.iec.ch" in the data related to the specific publication. At this date, the  
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318 • withdrawn,  
319 • replaced by a revised edition, or  
320 • amended.

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## INTRODUCTION

325 The spatial and temporal distribution of acoustic pressure in an ultrasonic field in a liquid  
326 medium is commonly determined using miniature ultrasonic **hydrophones**. These devices are  
327 not absolute measurement instruments and require calibration. The purpose of this part of  
328 IEC 62127 is to specify those calibration methods to be used in determining the response of a  
329 **hydrophone** in the ultrasonic range, i.e. above 20 kHz. The main **hydrophone** application in  
330 this context lies in the measurement of ultrasonic fields emitted by medical diagnostic  
331 equipment in water. **Hydrophone** behaviour over a wide frequency band is required in order to  
332 reliably characterize the acoustic parameters of the applied acoustic field. In particular, the  
333 frequency range above 15 MHz is important to fully characterize this equipment, primarily due  
334 to the increased appearance of high-frequency components in the ultrasonic signals, caused  
335 by nonlinear propagation. In addition, the number of medical ultrasonic systems that use  
336 frequencies above 15 MHz, particularly intra-operative probes, is growing. It has turned out in  
337 recent years that the **hydrophone** response below 0,5 MHz is also required to reliably  
338 determine the peak-negative (rarefactional) acoustic pressure.

339 While the term "**hydrophone**" can be used in a wider sense, it is understood here as referring  
340 to miniature piezoelectric **hydrophones**. It is this instrument type that is used today in various  
341 areas of medical ultrasonics and, in particular, to characterize quantitatively the field structure  
342 of medical diagnostic instruments [1]<sup>1</sup>. With regard to other pressure sensor types, such as  
343 those based on fibre optics, some of the requirements of this standard are applicable to these  
344 as well but others are not. If in the future these other "**hydrophone**" types gain more importance  
345 in field measurement practice, their characteristics and calibration will have to be dealt with in  
346 a revised version of this standard or in a separate one.

347 NOTE 1 This standard covers the ultrasonic frequency range, from 50 kHz to an upper frequency of 100 MHz. Not  
348 all techniques described are applicable to the full frequency range. Standards dealing with **hydrophone** properties  
349 (IEC 62127-3) and **hydrophone** use (IEC 62127-1) are being maintained in parallel. This will eventually lead to  
350 unified standards covering the whole field of practical **hydrophone** application.

351 NOTE 2 **Hydrophone** calibration in the lower ultrasonic and in the underwater sound frequency range is particularly  
352 addressed in the IEC 60565 series.

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<sup>1</sup> Numbers in square brackets refer to the Bibliography.

## 354 ULTRASONICS – HYDROPHONES –

### 355 Part 2: Calibration for ultrasonic fields

356  
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#### 359 1 Scope

360 This part of IEC 62127 specifies:

- 361 • absolute **hydrophone** calibration methods;
- 362 • relative (comparative) **hydrophone** calibration methods.

363 Recommendations and references to accepted literature are made for the various relative and  
364 absolute calibration methods in the frequency range covered by this standard.

365 This standard is applicable to

- 366 • **hydrophones** used for measurements made in water and in the ultrasonic frequency range  
367 50 kHz to 100 MHz;

368 NOTE 1 Although some physiotherapy medical applications of medical ultrasound are developing which  
369 operate in the frequency range 40 kHz to 100 kHz, the primary frequency range of diagnostic imaging remains  
370 above 2 MHz. It has recently been established that, even in the latter case, the **hydrophone** response at  
371 substantially lower frequencies can influence measurements made of key acoustic parameters [2].

372 NOTE 2 Calibration methods for underwater acoustics hydrophones applicable in the frequency range from  
373 200 Hz to 1 MHz are available in IEC 60565-1, and for frequencies from 0,01 Hz to several kHz in IEC 60565-2.

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

376 NOTE 3 Some hydrophones can have non-circular active elements, arising from slight deviations from a circular  
377 structure caused, for example by electrode structure, or conversely, the active elements can actually be squares.  
378 The clauses within this standard remain valid, although, in these cases, special attention should be paid to the  
379 directional response and to the effective radii of the active element through various axes of rotation.

- 380 • **hydrophones** with or without a hydrophone pre-amplifier.

#### 381 2 Normative references

382 The following referenced documents are indispensable for the application of this document. For  
383 dated references, only the edition cited applies. For undated references, the latest edition of  
384 the referenced document (including any amendments) applies.

385 IEC 60050-801, *International Electrotechnical Vocabulary – Chapter 801: Acoustics and*  
386 *electroacoustics*

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

389 IEC 60565-2, *Underwater acoustics – Hydrophones – Calibration of hydrophones – Part 2:*  
390 *Procedures for low frequency pressure calibration*

391 IEC 61161, *Ultrasonics – Power measurement – Radiation force balances and performance*  
392 *requirements*

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