SLOVENSKI STANDARD

SIST EN 60565:2008

01-januar-2008

Podvodna akustika - Hidrofoni - Kalibracija v frekvenļnem obmoļju od 0,01 Hz do 1 MHz (IEC 60565:2006)

Underwater acoustics - Hydrophones - Calibration in the frequency range 0,01 Hz to 1 MHz (IEC 60565:2006)

Wasserschall - Hydrophone - Kalibrierung im Frequenzbereich von 0,01 Hz bis 1 MHz (IEC 60565:2006)

Acoustique sous-marine - Hydrophones - Etalonnage dans la bande de fréquences de 0,01 Hz a 1 MHz (IEC 60565:2006)

Ta slovenski standard je istoveten z: **EN 60565:2007**

ICS:

17.140.50	Elektroakustika	Electroacoustics

SIST EN 60565:2008	**en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60565

January 2007

ICS 17.140.50

English version

Underwater acoustics - Hydrophones - Calibration in the frequency range 0,01 Hz to 1 MHz

(IEC 60565:2006)

Acoustique sous-marine -
Hydrophones -
Etalonnage dans la bande de fréquences
de 0,01 Hz à 1 MHz
(CEI 60565:2006)

Wasserschall -
Hydrophone -
Kalibrierung im Frequenzbereich
von 0,01 Hz bis 1 MHz
(IEC 60565:2006)

This European Standard was approved by CENELEC on 2006-12-01. 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.

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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 60565:2007 E

Foreword

The text of document 87/357/FDIS, future edition 2 of IEC 60565, prepared by IEC TC 87, Ultrasonics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60565 on 2006-12-01.

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)	2007-09-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2009-12-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60565:2006 was approved by CENELEC as a European Standard without any modification.

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 60050-801	-[1)]	International Electrotechnical Vocabulary (IEV) Chapter 801: Acoustics and electroacoustics	-	-
IEC 60500	1974	IEC standard hydrophone	-	-
IEC 60866	1987	Characteristics and calibration of hydrophones for operation in the frequency range 0,5 MHz to 15 MHz	-	-

[1)] Undated reference.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
60565

Deuxième édition
Second edition
2006-11

Acoustique sous-marine – Hydrophones – Étalonnage dans la bande de fréquences de 0,01 Hz à 1 MHz

Underwater acoustics – Hydrophones – Calibration in the frequency range 0,01 Hz to 1 MHz

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International Electrotechnical Commission
Международная Электротехническая Комиссия

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For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

UNDERWATER ACOUSTICS – HYDROPHONES – CALIBRATION IN THE FREQUENCY RANGE 0,01 Hz TO 1 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 60565 has been prepared by IEC technical committee 87: Ultrasonics.

This second edition cancels and replaces the first edition published in 1977 and its first supplement IEC 60565A (1980). This edition constitutes a technical revision. The significant technical changes with respect to the previous edition are as follows:

– updating of procedures to reflect the use of digital acquisition and signal processing techniques as opposed to the analogue techniques described in the first edition;

– inclusion of more detailed information regarding the preparation of hydrophones for measurement, and the influences of environmental conditions on hydrophone calibration;

– revision of procedures for magnitude calibration of hydrophone response by the method of three-transducer spherical-wave reciprocity;

– inclusion of procedures for phase calibration into the method of three-transducer spherical-wave reciprocity;

– revision of procedures for calibration of hydrophones by the comparison methods;
– inclusion of procedures for low frequency hydrophone calibration utilising the method of hydrostatic excitation;
– revision of the procedures for low frequency hydrophone calibration utilising the method of piezoelectric compensation;
– inclusion of procedures for low frequency hydrophone calibration utilising the method of coupler reciprocity;
– revision of the procedures for low frequency hydrophone calibration utilising the pistonphone method;
– revision of procedures for low frequency hydrophone calibration utilising the method of vibrating column (previously issued as a supplement to the standard);
– deletion of Appendix A of first edition (transfer impedance by substitution method) since method no longer used;
– deletion of Appendix B of first edition (transfer impedance by direct read-out method) since method no longer used;
– retention of Appendix C of first edition, but now substantially updated and included as Annex C (informative);
– retention of Appendix D of first edition, now included as Annex A (informative);
– addition of new Annex B describing methods for accounting for electrical loading of hydrophones by pre-amplifiers;
– addition of new Annex D describing the assessment of uncertainty in free-field hydrophone calibrations;
– addition of new Annex E describing an equivalent electrical circuit of the excitation system for calibration with a vibrating column.

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

FDIS	Report on voting
87/357/FDIS	87/360/RVD

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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site 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.

UNDERWATER ACOUSTICS – HYDROPHONES – CALIBRATION IN THE FREQUENCY RANGE 0,01 Hz TO 1 MHz

1 Scope

This International Standard specifies methods for calibration of hydrophones or reversible transducers when used as a hydrophone, particularly in the frequency range from 0,01 Hz to 1 MHz. Rules for the presentation of the calibration data are established.

2 Normative references

The following referenced data 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 60050-801, *International Electrotechnical Vocabulary - Chapter 801: Acoustics and electroacoustics*

IEC 60500:1974, *IEC Standard hydrophone*

IEC 60866:1987, *Characteristics and calibration of hydrophones for operation in the frequency range 0,5 MHz to 15 MHz*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
angular deviation loss
sensitivity level of the transducer on the principal axis minus the sensitivity level of the transducer for a specified direction

[IEV 801-25-69]

3.2
co-ordinate system
system used to designate the directivity pattern of the transducer

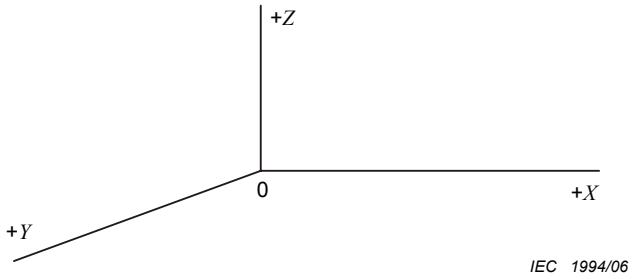

Figure 1 – Left-hand co-ordinate system

Line transducer: central line of symmetry along the Z-axis;

Dipole transducer: both components equidistant from the origin, along the +Z and –Z axis;

Piston transducer: piston plane in ZOY-plane; principal axis along X-axis.

NOTE 1 The terms 'horizontal directivity pattern' and 'vertical directivity pattern' are often used for representation of directivity in the XY- and XZ- (or YZ-) planes respectively.

NOTE 2 See Annex A, [1][1], [2].

3.3
coupler
apparatus comprising a rigid fluid-filled chamber of small dimensions into which transducers and hydrophones can be inserted

3.4
diffraction factor
ratio of the average pressure over the part of the hydrophone designed to receive sound to the free-field sound pressure that would exist at the reference centre of the hydrophone

3.5
directional response
description, generally presented graphically, of the response of an electro-acoustic transducer, as a function of the direction of propagation of the radiated or incident sound in a specified plane through the reference centre and at a specified frequency

NOTE See Annex A.

3.6
dynamic range
ratio of the maximum free field sound pressure that produces an undistorted hydrophone output to the equivalent noise pressure at the hydrophone

3.7
electrical impedance of a transducer
complex ratio of the instantaneous voltage applied across the electrical terminals of a transducer at a given frequency, to the resulting instantaneous current

NOTE 1 The unit is the ohm, Ω.

NOTE 2 Because the electrical impedance depends on the field conditions, the hydrostatic pressure, water temperature and the length of the cable attached to the transducer, these parameters, as well as the frequency and the electrical terminals where the electrical impedance is measured should be specified.

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[1] Numbers in square brackets refer to the bibliography

3.8
electrical terminals of a reciprocal transducer
terminals across which the open circuit hydrophone voltage , as well as the projector current are measured

NOTE If the transducer is immersed in water, the electrical terminal with the lowest electrical impedance with respect to water is called the 'low terminal'. Consequently, the other electrical terminal is called the 'high terminal'.

3.9
electrical transfer impedance magnitude
magnitude of the electrical transfer impedance of a transducer pair

NOTE The unit is the ohm, Ω.

3.10
electrical transfer impedance of a transducer pair
complex ratio of the open circuit instantaneous voltage U_H across the hydrophone electrical terminals to the instantaneous current I_P through the projector, if projector and hydrophone are mounted in a free field with their principal axes in line and directed towards each other

NOTE 1 $$Z_{PH} = \frac{U_H}{I_P} \quad (1)$$

NOTE 2 The unit is the ohm, Ω.

NOTE 3 The electrical transfer impedance is a complex quantity. It has both real and imaginary components and can be represented as a magnitude $|Z_{PH}|$ times a phase term $\exp(j\varphi)$, where φ is the phase angle between the real and imaginary impedance components.

NOTE 4 The definition of principal axis is given in 3.23.

NOTE 5 See 7.5.

3.11
equivalent noise pressure
sound pressure applied at the hydrophone to cause a voltage at the hydrophone electrical terminals, in the absence of noise, that is equal to the noise voltage present at the same electrical terminals when the sound pressure is absent

NOTE When the equivalent noise pressure cannot be measured, it can be calculated from the equivalent series resistance [2].

3.12
far field
sound field at a distance from the sound source where the instantaneous values of sound pressure and particle velocity are substantially in phase

NOTE 1 In the far field, the sound pressure appears to be spherically divergent from a point on or near the radiating surface. Hence, the pressure produced by the sound source is inversely proportional to the distance from that source.

NOTE 2 For all practical calibrations, the separation distance between the sound source and the point where the pressure is measured is sufficiently large that the sound pressure is measured in the far field of the source.

3.13
free field
sound field in a homogeneous and isotropic medium in which the effects of the boundaries are negligible