ALLVEEAKUSTIKA
Terminoloogia

Underwater acoustics
Terminology
(ISO 18405:2017, identical)

EESTI STANDARDIKESKUS
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EESTI STANDARDI EESSÕNA / NATIONAL FOREWORD

EESTI STANDARDI EESSÕNA	NATIONAL FOREWORD
See Eesti standard EVS-ISO 18405:2020 „Allveeakustika. Terminoloogia“ sisaldab rahvusvahelise standardi ISO 18405:2017 „Underwater acoustics. Terminology“ identset ingliskeelset teksti.	This Estonian Standard EVS-ISO 18405:2020 consists of the identical English text of the International Standard ISO 18405:2017 „Underwater acoustics. Terminology“.
Ettepaneku rahvusvahelise standardi ümbertrüki meetodil ülevõtuks on esitanud EVS/TK 61, standardi avaldamist on korraldanud Eesti Standardikeskus.	Proposal to adopt the International Standard by reprint method has been presented by EVS/TK 61, the Estonian Standard has been published by the Estonian Centre for Standardisation.
Standard EVS-ISO 18405:2020 on jõustunud sellekohase teate avaldamisega EVS Teataja 2020. aasta maikuu numbris.	Standard EVS-ISO 18405:2020 has been endorsed with a notification published in the May 2020 issue of the official bulletin of the Estonian Centre for Standardisation.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Käsitlusala

Selles dokumendis määratletakse terminid ja väljendid, mida kasutatakse allveeakustikas, kaasa arvatud looduslik, bioloogiline ja inimtekkeline heli. Dokumendis sisaldub veealuse heli teke, levi ja vastuvõtmine ning selle hajumine, sealhulgas peegeldumine allveekeskkonnas, mis hõlmab merepõhja, veepinda ja elusorganisme. See sisaldab ka kõiki aspekte, mis käsitlevad veealuse heli mõju veealusele keskkonnale, inimestele ja vee-elustikule. Allveeakustiliste süsteemide omadusi ei käsitleta.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 3, *Underwater acoustics*.

Introduction

0.1 Overview

Vocabulary is the most basic of subjects for standardization. Without an accepted standard for the definition of terminology, the production of scientific and engineering publications in a technical area, including the development of standards for measurement, processing or modelling in that area, becomes a laborious and time-consuming task that would ultimately result in the inefficient use of time and a high probability of misinterpretation.

Basic terminology of underwater acoustics is defined in 3.1, followed by levels in 3.2. These are followed by definitions of terms associated with sources of sound (3.3), propagation and scattering (3.4), underwater sound signals (3.5), and sonar equations (3.6). Finally, 3.7 defines basic bioacoustical terminology used in underwater acoustics.

0.2 Approach

The underlying philosophy followed in preparing this document is to define quantities independently of how they are measured.

0.3 Remark on exceptions to the ISO/IEC 80000 series

In this document, the ISO/IEC 80000 series is followed for the definitions of physical quantities, including the level of a power quantity and level of a field quantity. Two exceptions are made to this general rule, as follows.

— Inconsistencies between ISO 80000-1 and ISO 80000-3 make it necessary to choose between them (for example, the term “field quantity” used in ISO 80000-3 is deprecated by ISO 80000-1:2009, Annex C, which prefers the term “root-power quantity”). This document follows ISO 80000-3, which makes it incompatible with ISO 80000-1.

— The term “sound pressure level” is defined by ISO 80000-8 in a way that does not reflect conventional use of this term to mean the level of the mean-square sound pressure. This convention is reflected in ISO 80000-8 by the notes in the “Remarks” column alongside the definition. These remarks are inconsistent with the definition, making it necessary to choose between the definition and the remarks. This document follows the “Remarks”, which makes it incompatible with the ISO 80000-8 definition of “sound pressure level”.

0.4 Remark on levels and level differences, and their reference values

Levels used in underwater acoustics are defined in 3.2. In its most general form, a level L_Q of a quantity Q is defined in the International System of Quantities (see ISO 80000-3) as the logarithm of the ratio of the quantity Q to its reference value, Q_0. In formula form, this definition can be written as

$$L_Q = \log_r(Q/Q_0).$$

The nature of the quantity (Q), its reference value (Q_0) and the base of the logarithm (r) should all be specified. Reference values for use in underwater acoustics are specified by ISO 1683.

Two types of level are in widespread use in underwater acoustics, the level of a field quantity (see ISO 80000-3:2006, 3-21) and the level of a power quantity (see ISO 80000-3:2006, 3-22). In underwater acoustics, it is conventional to express both types of level in decibels (dB). When expressed in decibels, the level L_F of a field quantity F is

$$L_F = 20 \log_{10}(F/F_0) \text{ dB},$$

where F_0 is the reference value of the field quantity. Similarly, the level L_P of a power quantity P is

$$L_P = 10 \log_{10}(P/P_0) \text{ dB},$$

where P_0 is the reference value of the power quantity. This definition of L_P is a product of the three factors 10, $\log_{10}(P/P_0)$ and 1 dB. In words, this product is written in this document as "ten times the logarithm to the base 10 of the ratio P/P_0, in decibels". For levels of both field and power quantities, the nature of the quantity (F or P) is implied by the name of the level, while the base of the logarithm is implied by the use of decibel as the unit. For all levels, the reference value is stated explicitly. The use by this document of the definitions of "level" and "decibel" from ISO 80000-3 results in inconsistencies between this document and ISO 80000-1 because of inconsistencies between ISO 80000-3 and ISO 80000-1:2009, Annex C.

Level differences [i.e. differences between levels of like quantities (see ANSI/ASA S1.1-2013, 10.44)] are also expressed in decibels. For example, if P_1 and P_2 are power quantities of the same kind, and $L_{P,1}$ and $L_{P,2}$ are their respective levels, the corresponding level difference is

$$\Delta L_P = L_{P,1} - L_{P,2} = 10 \log_{10}(P_1/P_0) \text{ dB} - 10 \log_{10}(P_2/P_0) \text{ dB} = 10 \log_{10}(P_1/P_2) \text{ dB}.$$

Similarly, for like field quantities F_1 and F_2, with respective levels, $L_{F,1}$ and $L_{F,2}$,

$$\Delta L_F = L_{F,1} - L_{F,2} = 20 \log_{10}(F_1/F_0) \text{ dB} - 20 \log_{10}(F_2/F_0) \text{ dB} = 20 \log_{10}(F_1/F_2) \text{ dB}.$$

Examples of level difference are transmission loss, array gain, and hearing threshold shift.

Differences between levels of power quantities of different kinds are encountered in 3.6 and 3.7 in connection with the response of underwater systems, and are also expressed in decibels. For example, if A and B are two power quantities, with A being a measure of the response signal (output) of a system and B a measure of the forcing signal (input), such that the system sensitivity is $S = A/B$, the sensitivity level of that system is

$$N_S = L_A - L_B = 10 \log_{10} (A/A_0) \text{ dB} - 10 \log_{10} (B/B_0) \text{ dB} = 10\log_{10}(S/S_0) \text{ dB}$$

where S_0, the reference value of the sensitivity, is equal to A_0/B_0.

An example of sensitivity level in underwater acoustics is target strength (reference value = 1 m^2). If this quantity were expressed instead as the difference between levels of field quantities, defined as the square root of the respective power quantities, the reference value would then become 1 m.

0.5 Remark on reference values of root-power quantities

For every real, positive power quantity, P, there exists a root-power quantity, F_{rp}, equal to the square root of P (see ISO 80000-1:2009), that is, $F_{\text{rp}} = P^{1/2}$. The level of this root-power quantity is

$$L_{F,\text{rp}} = 20 \log_{10}(F_{\text{rp}}/F_0) \text{ dB}.$$

This level is equal to L_P if the reference value F_0 is given by $F_0 = P_0^{1/2}$. Selected power quantities and their respective reference values are listed in columns 1 and 2 of Table 1. The corresponding root-power quantities and their respective reference values are listed in columns 3 and 4 of Table 1. A field quantity is "a quantity whose square is proportional to power when it acts on a linear system" (see ISO 80000-3), so all root-power quantities are also field quantities. For example, the level of mean-square sound pressure, with reference value 1 μPa^2, is equal to that of root-mean-square sound pressure, with reference value 1 µPa. These two reference values are therefore used interchangeably for sound pressure level.

Table 1 — Power quantities, their corresponding root-power quantities, and their reference values, based on Reference [21]

Power quantity (P)	Reference value (P_0)	Corresponding root-power quantity ($F_{rp} = P^{1/2}$)	Reference value ($F_0 = P_0^{1/2}$)
Mean-square sound pressure	1 µPa^2	Root-mean-square sound pressure	1 µPa
Mean-square sound particle displacement	1 pm^2	Root-mean-square sound particle displacement	1 pm
Mean-square sound particle velocity	1 nm^2/s^2	Root-mean-square sound particle velocity	1 nm/s
Mean-square sound particle acceleration	1 µm^2/s^4	Root-mean-square sound particle acceleration	1 µm/s^2
Sound exposure	1 µPa^2 s	Root sound exposure	1 µPa s$^{1/2}$
Sound power	1 pW	Root sound power	1 pW$^{1/2}$
Sound energy	1 pJ	Root sound energy	1 pJ$^{1/2}$
Source factor	1 µPa^2 m^2	Root source factor	1 µPa m
Propagation factor	1 m^2	Root propagation factor	1 m

0.6 Remark on the usage of “acoustic” and “sound” in this document

This document recognizes the interchangeability of the words “acoustic” and “sound” when the word “sound” is used as part of a compound noun, and not otherwise.

Underwater acoustics — Terminology

1 Scope

This document defines terms and expressions used in the field of underwater acoustics, including natural, biological and anthropogenic (i.e. man-made) sound. It includes the generation, propagation and reception of underwater sound and its scattering, including reflection, in the underwater environment including the seabed (or sea bottom), sea surface and biological organisms. It also includes all aspects of the effects of underwater sound on the underwater environment, humans and aquatic life. The properties of underwater acoustical systems are excluded.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General terms

3.1.1 General

3.1.1.1
sound
alteration in pressure, stress or material displacement propagated via the action of elastic stresses in an elastic medium and that involves local compression and expansion of the medium, or the superposition of such propagated alterations

Note 1 to entry: The medium in which the sound exists is often indicated by an appropriate adjective, e.g. airborne, water-borne, or structure-borne.

Note 2 to entry: In the remainder of this document, the medium is assumed to be a compressible fluid.

Note 3 to entry: A sound wave is a realization of sound.

Note 4 to entry: The word “sound” may also be used as part of a compound noun, in which case, it is a synonym of “acoustic”. For example, “acoustic pressure” and “acoustic power”’ are synonyms of *sound pressure* (3.1.2.1) and *sound power* (3.1.3.14).

[SOURCE: Reference [23] and Reference [35]]

3.1.1.2
ambient sound
sound (3.1.1.1) that would be present in the absence of a specified activity

Note 1 to entry: Ambient sound is location-specific and time-specific.

Note 2 to entry: In the absence of a specified activity, all sound is ambient sound.

