Akustika. Müraallikate helivõimsuse taseme määramine helirõhu abil. Täppismeetodid lairiba-allikate jaoks reverberatsiooniruumides

Acoustics - Determination of sound power levels of noise sources using sound pressure - Precision methods for reverberation rooms

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 3741:2009 sisaldab Euroopa standardi EN ISO 3741:2009 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 3741:2009 consists of the English text of the European standard EN ISO 3741:2009.
Standard on kinnitatud Eesti Standardikeskuse 30.09.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 30.09.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 29.07.2009.	Date of Availability of the European standard text 29.07.2009.
Standard on kättesaadav Eesti standardiorganisatsioonist.	The standard is available from Estonian standardisation organisation.

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EUROPEAN STANDARD

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English Version

Acoustics - Determination of sound power levels of noise sources using sound pressure - Precision methods for reverberation rooms (ISO 3741:1999, including Cor 1:2001)

Acoustique - Détermination des niveaux de puissance acoustique émis par les sources de bruit à partir de la pression acoustique - Méthodes de laboratoire en salles réverbérantes (ISO 3741:1999, Cor 1:2001 inclus)

Akustik - Ermittlung der Schalleistungspegel von Geräuschquellen durch Schalldruckmessungen - Hallraumverfahren der Genauigkeitsklasse 1 (ISO 3741:1999, einschließlich Cor 1:2001)

This European Standard was approved by CEN on 13 July 2009.

CEN 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 CEN Management Centre or to any CEN member.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of ISO 3741:1999, including Cor 1:2001 has been prepared by Technical Committee ISO/TC 43 “Acoustics” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 3741:2009 by Technical Committee CEN/TC 211 “Acoustics” the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 3741:1999.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of E Directives.

For relationship with EC Directives, see informative Annexes ZA and ZB, which are integral parts of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 3741:1999, including Cor 1:2001 has been approved by CEN as a EN ISO 3741:2009 without any modification.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 98/37/EC, amended by 98/79/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING - Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Annex ZB
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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0 Introduction

0.1 This International Standard is one of the ISO 3740 series, which specifies various methods for determining the sound power levels of machines, equipment, and their sub-assemblies. When selecting one of the methods of the ISO 3740 series, it is necessary to select the most appropriate for the conditions and purpose of the test. General guidelines to assist in the selection are provided in ISO 12001 and ISO 3740. The ISO 3740 series gives only general principles regarding the operating and mounting conditions of the machine or equipment under test. Reference should be made to the noise test code for a specific type of machine or equipment, if available, for specifications on mounting and operating conditions.

0.2 This International Standard specifies laboratory methods for determining the sound power radiated by sources as a function of frequency, using a reverberation test room having specified acoustical characteristics. If a room having these characteristics is not available, other documents of the series of basic standards with different environmental requirements are offered (see Table 1 and ISO 3744 or ISO 9614).

In this International Standard, the computation of sound power from sound pressure measurements is based on the premise that, for a source emitting a given sound power in the reverberation test room, the mean-square sound pressure averaged in space and time, $\overline{p^2}$, is directly proportional to the sound power and otherwise depends only on the acoustical and geometric properties of the room and on the physical constants of air.

If a source emits narrow-band or discrete-frequency sound, a precise determination of the radiated sound power level requires greater effort. The reasons are as follows:

a) the space/time-averaged sound pressure along a short microphone path, or as determined with an array of a small number of microphones, is not always a good estimate of the space/time averaged mean-square pressure throughout the room;

b) the sound power radiated by the sources is more strongly influenced by the normal modes of the room and by the position of the source within the room.

If narrow bands of noise or discrete tones are emitted by a source, a determination of its sound power level in a reverberation room requires either the optimization and qualification of the room and test set-up (see annex A) or the use of a greater number of source locations and microphone positions (or greater path length for a moving microphone). These numbers can be reduced by adding low frequency absorbers to decrease the reverberation time. It is also helpful if one or more diffusers are rotating in the test room during the measurements. Guidelines for the design of suitable rotating diffusers are given in annex B.

Table 1 — Overview of International Standards for determination of sound power levels of noise sources under reverberation conditions giving different grades of accuracy

Parameter	**ISO 3741** **Precision method** **Grade 1**	**ISO 3743-1** **Engineering method** **Grade 2**	**ISO 3743-2** **Engineering method** **Grade 2**
Test environment	**Reverberation room**	**Hard-walled room**	**Special reverberation test room**
Criteria for suitability of test environment	Room volume, V, and reverberation time, T_{rev}, to be qualified	$V \geqslant 40$ m^3 and $V > 40\ V_Q$ Sound absorption coefficient $\overline{\alpha} < 0{,}20$ Special qualification	Specified requirements
Volume of sound source V_Q	Preferably less than 2 % of test room volume	Preferably less than 2,5 % of test room volume	
Character of noise	Steady, broad-band, narrow-band, discrete frequencies	Any, but no isolated bursts	
Limitation for background noise	$\Delta L \geqslant 10$ dB	$\Delta L \geqslant 6$ dB	$\Delta L \geqslant 4$ dB
Number N_M of measuring positions	$N_M \geqslant 6$ or a continuous microphone traverse, if appropriate	$N_M \geqslant 3$ or a continuous microphone traverse, if appropriate	$N_M \geqslant 3$ or a continuous microphone traverse, if appropriate
Instrumentation: a) Sound level meter at least complying with b) Integrating sound level meter at least complying with c) Frequency band filter set at least complying with d) calibrator at least complying with	a) type 1 according to IEC 61672 b) type 1 according to IEC 61672 c) class 1 according to IEC 61260 d) class 1 according to IEC 60942		
Sound power levels to be obtained	In one-third-octave or octave bands	In octave bands	A-weighted and in octave bands
	A-weighted (to be calculated)		
Precision of method for determining L_{WA} expressed as standard deviation of reproducibility σ_R	$\sigma_R \leqslant 0{,}5$ dB	$\sigma_R \leqslant 1{,}5$ dB	$\sigma_R \leqslant 2{,}0$ dB
	(for sources which emit noise with a relatively "flat" spectrum)		

Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms

1 Scope

1.1 This International Standard specifies a direct method and a comparison method for determining the sound power level that would be produced by a source operating in an environment at standard meteorological conditions corresponding to a characteristic impedance of $\rho c = 400$ N·s/m^3 (where ρ is the density of air and c is the speed of sound). It specifies test room requirements, source location and general rules for operating conditions, instrumentation and techniques for obtaining an estimate of mean-square sound pressure levels from which the sound power levels of the source in octave or one-third-octave bands are calculated with a grade 1 accuracy. The quantities to be measured are time-averaged sound pressure levels in frequency bands. The quantities to be determined are sound power levels, A-weighted and in frequency bands. Other quantities, which are optional, are sound power levels with other frequency weightings calculated from the measurements in frequency bands. This standard does not provide the means to determine directivity and temporal variation of sound from a source.

In general, the frequency range of interest includes the one-third-octave bands with midband frequencies from 100 Hz to 10 000 Hz. Guidelines for the application of the specified methods in an extended frequency range in respect to lower frequencies are given in annex C. This International Standard is not applicable to frequency ranges above the 10 000 Hz one-third-octave band. For higher frequencies the use of methods given in ISO 9295 is recommended.

1.2 The method specified in this International Standard is suitable for steady noise with broad-band, narrow-band and discrete-frequency components as described in ISO 12001. The noise may be emitted from a device, machine, component or sub-assembly.

This International Standard is applicable to noise sources with volumes which are preferably not greater than 2 % of the volume of the reverberation room used for the test. For sources with volumes greater than 2 % of the room volume, the standard deviations given by Table 2 could be exceeded.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 354, *Acoustics — Measurement of sound absorption in a reverberation room.*

ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment.*

ISO 6926, *Acoustics — Determination of sound power levels of noise sources — Requirements for the performance and calibration of reference sound sources.*

ISO 7574-1:1985, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 1: General considerations and definitions.*

ISO 7574-4:1985, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 4: Methods for stated values for batches of machines.*

ISO 12001, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code.*

IEC 60942, *Sound calibrators.*

IEC 61183, *Electroacoustics — Random-incidence and diffuse-field calibration of sound level meters.*

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters.*

IEC 61672, *Electroacoustics — Sound level meters.*

3 Terms and definitions

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

3.1
reverberation room
a test room meeting the requirements of this International Standard

3.2
reverberant sound field
that portion of the sound field in the test room over which the influence of sound received directly from the source is negligible

3.3
sound pressure
p
fluctuating pressure superimposed on the static pressure by the presence of sound

NOTE 1 It is expressed in pascals.

NOTE 2 The magnitude of the sound pressure can be expressed in several ways, but for this International Standard only the square root of the mean-square sound pressure over designated time and space is relevant.

3.4
mean-square sound pressure
$\overline{p^2}$

sound pressure averaged in space and time on a mean-square basis

NOTE In practice, space/time-averaging over a finite path length or a fixed number of microphone positions as well as deviations from the ideally reverberant sound field lead only to an estimate of $\overline{p^2}$.

3.5
sound pressure level
L_p
ten times the logarithm to the base 10 of the ratio of the square of the sound pressure to the square of the reference sound pressure

NOTE Sound pressure levels are expressed in decibels. The reference sound pressure is 20 μPa (2×10^{-5} Pa).