SLOVENSKI STANDARD
SIST EN ISO 3741:2010

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Nadomešča:
SIST EN ISO 3741:2009

Akustika - Določanje ravni zvočnih moči in ravni zvočne energije virov hrupa z zvočnim tlakom - Precizijska metoda za odmevnice (ISO 3741:2010)

Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms (ISO 3741:2010)

Akustik - Bestimmung der Schallleistungs- und Schallenergiepegel von Geräusch-quellen aus Schalldruckmessungen - Hallraumverfahren der Genauigkeitsklasse 1 (ISO 3741:2010)

Acoustique - Détermination des niveaux de puissance acoustique et des niveaux d'énergie acoustique émis par les sources de bruit a partir de la pression acoustique - Méthodes de laboratoire en salles d'essais réverbérantes (ISO 3741:2010)

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN ISO 3741

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English Version

Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms (ISO 3741:2010)

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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 CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

The text of ISO 3741:2010 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 3741:2010 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of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.

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 3741:2009.

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 EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part 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, Croatia, 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 3741:2010 has been approved by CEN as a EN ISO 3741:2010 without any modification.

Annex ZA
(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 one 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 products falling within the scope of this standard.

INTERNATIONAL STANDARD

ISO 3741

Fourth edition
2010-10-01

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

Acoustique — Détermination des niveaux de puissance et des niveaux d'énergie acoustiques émis par les sources de bruit à partir de la pression acoustique — Méthodes de laboratoire en salles d'essais réverbérantes

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 3741 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This fourth edition cancels and replaces the third edition (ISO 3741:1999), which has been technically revised. It also incorporates the Technical Corrigendum ISO 3741:1999/Cor.1:2001.

Introduction

This International Standard is one of the series ISO 3740[2] to ISO 3747[8], which specify various methods for determining the sound power levels and sound energy levels of noise sources including machinery, equipment and their sub-assemblies. The selection of one of the methods from the series for use in a particular application depends on the purpose of the test to determine the sound power level or sound energy level and on the facilities available. General guidelines to assist in the selection are provided in ISO 3740[2]. ISO 3740[2] to ISO 3747[8] give only general principles regarding the operating and mounting conditions of the machinery or equipment for the purposes of the test. It is important that test codes be established for individual kinds of noise source, in order to give detailed requirements for mounting, loading, and operating conditions under which the sound power levels or sound energy levels are to be obtained.

The methods given in this International Standard require the source under test to be mounted in a reverberation test room having specified acoustical characteristics. The methods are then based on the premise that the sound power or sound energy of the source under test is directly proportional to the mean-square sound pressure averaged in space and time, and otherwise depends only on the acoustical and geometric properties of the room and on the physical constants of air.

For a source emitting sound in narrow bands of frequency or at discrete frequencies, a precise determination of the radiated sound power level or sound energy level in a reverberation test room requires greater effort than for a source emitting sound more evenly over a wide range of frequencies, because:

a) the space- and 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- or time-averaged mean-square pressure throughout the room;

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

The increased measurement effort in the case of a source emitting narrow bands of sound or discrete tones consists of either the optimization and qualification of the test room or the use of a greater number of source locations and microphone positions (or increased path length for a moving microphone). The addition of low-frequency absorbers or the installation of rotating diffusers in the test room can help to reduce the measurement effort.

The methods specified in this International Standard permit the determination of the sound power level and the sound energy level in one-third-octave frequency bands, from which octave band data, A-weighted frequency data, and total unweighted sound can be computed.

This International Standard describes methods of accuracy grade 1 (precision grade) as defined in ISO 12001. The resulting sound power levels and sound energy levels include corrections to allow for any differences that might exist between the meteorological conditions under which the tests are conducted and reference meteorological conditions. For applications in reverberant environments where reduced accuracy is acceptable, reference can be made to ISO 3743-1[3], ISO 3743-2[4] or ISO 3747[8].

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

1 Scope

1.1 General

This International Standard specifies methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured in a reverberation test room. The sound power level (or, in the case of noise bursts or transient noise emission, the sound energy level) produced by the noise source, in frequency bands of width one-third-octave, is calculated using those measurements, including corrections to allow for any differences between the meteorological conditions at the time and place of the test and those corresponding to a reference characteristic impedance. Measurement and calculation procedures are given for both a direct method and a comparison method of determining the sound power level and the sound energy level.

In general, the frequency range of interest includes the one-third-octave bands with mid-band frequencies from 100 Hz to 10 000 Hz. Guidelines for the application of the specified methods over an extended frequency range in respect to lower frequencies are given in Annex E. This International Standard is not applicable to frequency ranges above the 10 000 Hz one-third-octave band.

NOTE For higher frequencies, the methods specified in ISO 9295 can be used.

1.2 Types of noise and noise sources

The methods specified in this International Standard are suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001.

The noise source under test can be a device, machine, component or sub-assembly. This International Standard is applicable to noise sources with a volume not greater than 2 % of the volume of the reverberation test room. For a source with a volume greater than 2 % of the volume of the test room, it is possible that the achievement of results as defined in ISO 12001:1996, accuracy grade 1 (precision grade) is not feasible.

NOTE In specific cases, the source volume can be increased to a maximum of 5 % of the room volume. In such cases, the relevant noise test code indicates the possible consequences on the measurement uncertainty.

1.3 Reverberation test room

The test rooms that are applicable for measurements made in accordance with this International Standard are reverberation test rooms meeting specified requirements (see Clause 5).

1.4 Measurement uncertainty

Information is given on the uncertainty of the sound power levels and sound energy levels determined in accordance with this International Standard, for measurements made in specific frequency bands and for the A-weighted sum of all frequency bands. The uncertainty conforms to ISO 12001:1996, accuracy grade 1 (precision grade).

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

ISO 3382-2, *Acoustics — Measurement of room acoustic parameters — Part 2: Reverberation time in ordinary rooms*

ISO 5725 (all parts), *Accuracy (trueness and precision) of measurement methods and results*

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

ISO 12001:1996, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code*

ISO/IEC Guide 98-3, *Uncertainty in measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

IEC 60942:2003, *Electroacoustics — Sound calibrators*

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

IEC 61260:1995, *Electroacoustics — Octave-band and fractional-octave-band filters*

IEC 61672-1:2002, *Electroacoustics — Sound level meters — Part 1: Specifications*

3 Terms and definitions

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

3.1
sound pressure
p
difference between instantaneous pressure and static pressure

NOTE 1 Adapted from ISO 80000-8:2007[21], 8-9.2.

NOTE 2 Sound pressure is expressed in pascals.

3.2
sound pressure level
L_p
ten times the logarithm to the base 10 of the ratio of the square of the sound pressure, p, to the square of a reference value, p_0, expressed in decibels

$$L_p = 10 \lg \frac{p^2}{p_0^2} \text{ dB} \quad (1)$$

where the reference value, p_0, is 20 μPa

[ISO/TR 25417:2007[20], 2.2]

NOTE 1 If specific frequency and time weightings as specified in IEC 61672-1 and/or specific frequency bands are applied, this is indicated by appropriate subscripts; e.g. L_{pA} denotes the A-weighted sound pressure level.

NOTE 2 This definition is technically in accordance with ISO 80000-8:2007[21], 8-22.

3.3
time-averaged sound pressure level
$L_{p,T}$
ten times the logarithm to the base 10 of the ratio of the time average of the square of the sound pressure, p, during a stated time interval of duration, T (starting at t_1 and ending at t_2), to the square of a reference value, p_0, expressed in decibels

$$L_{p,T} = 10 \lg \left[\frac{\frac{1}{T} \int_{t_1}^{t_2} p^2(t) \mathrm{d}t}{p_0^2} \right] \text{ dB} \tag{2}$$

where the reference value, p_0, is 20 µPa

NOTE 1 In general, the subscript "T" is omitted since time-averaged sound pressure levels are necessarily determined over a certain measurement time interval.

NOTE 2 Time-averaged sound pressure levels are often A-weighted, in which case they are denoted by $L_{pA,T}$, which is usually abbreviated to L_{pA}.

NOTE 3 Adapted from ISO/TR 25417:2007[20], 2.3.

3.4
single event time-integrated sound pressure level
L_E

ten times the logarithm to the base 10 of the ratio of the integral of the square of the sound pressure, p, of an isolated single sound event (burst of sound or transient sound) over a stated time interval T (starting at t_1 and ending at t_2) to a reference value, E_0, expressed in decibels

$$L_{E,T} = 10 \lg \left[\frac{\int_{t_1}^{t_2} p^2(t) \mathrm{d}t}{E_0} \right] \text{ dB} \tag{3}$$

where the reference value, E_0, is $(20\ \mu\text{Pa})^2\ \text{s} = 4 \times 10^{-10}\ \text{Pa}^2\ \text{s}$

NOTE 1 This quantity can be obtained by $L_{p,T} + 10 \lg \frac{T}{T_0}$ dB , where T_0 = 1 s.

NOTE 2 When used to measure sound immission, this quantity is usually called "sound exposure level" (see ISO/TR 25417:2007[20]).

3.5
measurement time interval
T
portion or a multiple of an operational period or operational cycle of the noise source under test for which the time-averaged sound pressure level is determined

NOTE Measurement time interval is expressed in seconds.