SLOVENSKI STANDARD
SIST EN 23741:1997

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Akustika - Ugotavljanje ravni zvočnih moči virov hrupa - Precizijska metoda za širokopasovne vire hrupa v odmevnicah (ISO 3741:1988)

Acoustics - Determination of sound power levels of noise sources - Precision methods for broad-band sources in reverberation rooms (ISO 3741:1988)

Bestimmung des Schalleistungspegels von Geräuschquellen - Rahmenmeßverfahren der Genauigkeitsklasse 1 für Breitbandspektren in Hallräumen (ISO 3741:1988)

Acoustique - Détermination des niveaux de puissance acoustique émis par les sources de bruit - Méthodes de laboratoire en salles réverbérantes pour les sources a large bande (ISO 3741:1988)

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English version

Acoustics - Determination of sound power levels of noise sources - Precision methods for broad-band sources in reverberation rooms (Identical with ISO 3741:1988)

Acoustique - Détermination des niveaux de puissance acoustique émis par les sources de bruit - Méthodes de laboratoire en salles réverbérantes pour les sources à large bande (Identique à l'ISO 3741:1988)

Bestimmung des Schalleistungspegels von Geräuschquellen - Rahmenmeßverfahren der Genauigkeitsklasse 1 für Breitbandspektren in Hallräumen (Identisch mit ISO 3741:1988)

This European Standard was approved by CEN on 1991-10-07 and is identical to the ISO standard as referred to.
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 Central Secretariat or to any CEN 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 CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been taken over by CEN/TC 211 "Acoustics" from the work of the International Organization for Standardization (ISO).

This document has been submitted to the formal vote and has been approved.

Natonal Standards identical to this European Standard shall be published at the latest by 92-04-09 and conflicting national standards shall be withdrawn at the latest 92-04-09.

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Endorsement notice

The text of the International Standard ISO 3741:1988 has been approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 3741

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Acoustics — Determination of sound power levels of noise sources — Precision methods for broad-band sources in reverberation rooms

Acoustique — Détermination des niveaux de puissance acoustique émis par les sources de bruit — Méthodes de laboratoire en salles réverbérantes pour les sources à large bande

Reference number
ISO 3741 : 1988 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3741 was prepared by Technical Committee ISO/TC 43, *Acoustics*.

This second edition cancels and replaces the first edition (ISO 3741 : 1975), of which it constitutes a minor revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Acoustics — Determination of sound power levels of noise sources — Precision methods for broad-band sources in reverberation rooms

0.1 Related International Standards

This International Standard is one of a series specifying various methods for determining the sound power levels of machines and equipment. These basic documents specify only the acoustical requirements for measurements appropriate for different test environments as shown in table 1.

When applying these basic documents, it is necessary to decide which one is most appropriate for the conditions and purposes of the test. The operating and mounting conditions of the machine or equipment to be tested are given as general principles stated in each of the basic documents. Guidelines for making these decisions are provided in ISO 3740. If no noise test code is specified for a particular machine, the mounting and operating conditions shall be fully described in the test report.

0.2 Synopsis of ISO 3741

0.2.1 Applicability

0.2.1.1 Test environment

Reverberation room with specified volume and absorption or qualified in accordance with a test procedure given in annex A. Guidelines for the design of reverberation rooms are given in annex D. The minimum test room volume depends on the lowest frequency band of interest (V_{min} = 200 m^3 corresponds to 100 Hz for the lowest allowable one-third octave band).

0.2.1.2 Size of noise source

Volume of the source preferably less than 1 % of volume of the test room.

0.2.1.3 Character of noise radiated by the source

Steady (as defined in ISO 2204), broad-band.

0.2.2 Precision

Measurements made in conformity with this International Standard will, with very few exceptions, result in standard deviations equal to or less than 1,5 dB from 400 to 5 000 Hz, 2 dB from 200 to 315 Hz, increasing to 3 dB below 200 Hz and above 5 000 Hz (see 1.3 and table 2).

0.2.3 Quantities to be measured

Sound pressure levels in frequency bands on a specified path or at several discrete microphone positions.

0.2.4 Quantities to be determined

Sound pressure levels in frequency bands; A-weighted sound power levels (optional).

0.2.5 Quantities which cannot be obtained

Directivity characteristics of the source; temporal pattern of radiated noise for sources emitting non-steady noise.

0.3 Introduction

This International Standard specifies in detail two laboratory methods for determining the sound power radiated by a device, machine, component, or sub-assembly as a function of frequency, using a reverberation test room having specified acoustical characteristics. While other methods could be used to measure the noise emitted by machinery and equipment, the methods specified in this International Standard are particularly advantageous for rating the sound output of sources which produce steady noise and for which directivity information is not required. If the source emits non-steady noise or if directivity information is desired, one of the other methods specified in ISO 3740 shall be selected.

Among the reasons for obtaining data as described in this International Standard are the following:

a) rating apparatus according to its sound power output;

b) establishing sound control measures;

c) predicting the sound pressure levels produced by a device or machine in a given enclosure or environment.

In this International Standard, the computation of sound power from sound pressure measurements is based on the premise that the mean-square sound pressure averaged in space and time, $\overline{p^2}$, is

a) directly proportional to the sound power output of the source,

b) inversely proportional to the equivalent absorption area of the room, and

c) otherwise depends only on the physical constants of air density and velocity of sound.

Table 1 — International Standards specifying various methods for determining the sound power levels of machines and equipment

International Standard No.*	Classification of method**	Test environment	Volume of source	Character of noise	Sound power levels obtainable	Optional information available
3741	Precision (grade 1)	Reverberation room meeting specified requirements	Preferably less than 1 % of test room volume	Steady, broad-band	In one-third octave or octave bands	A-weighted sound power level
3742				Steady, discrete-frequency or narrow-band		
3743	Engineering (grade 2)	Special reverberation test room		Steady, broad-band, narrow-band, or discrete-frequency	A-weighted and in octave bands	Other weighted sound power levels
3744	Engineering (grade 2)	Outdoors or in large room	Greatest dimension less than 15 m	Any	A-weighted and in one-third octave or octave bands	Directivity information and sound pressure levels as a function of time; other weighted sound power levels
3745	Precision (grade 1)	Anechoic or semi-anechoic room	Preferably less than 0,5 % of test room volume	Any		
3746	Survey (grade 3)	No special test environment	No restrictions: limited only by available test environment	Any	A-weighted	Sound pressure levels as a function of time; other weighted sound power levels
3747	Survey (grade 3)	No special test environment; source under test not movable	No restrictions	Steady, broad-band, narrow-band, or discrete-frequency	A-weighted	Sound power levels in octave bands

* See clause 2.

** See ISO 2204.

1 Scope and field of application

1.1 General

This International Standard specifies a direct method and a comparison method for determining the sound power level produced by a source. It specifies test room requirements, source location and operating conditions, instrumentation and techniques for obtaining an estimate of mean-square sound pressure from which the sound power level of the source in octave or one-third octave bands is calculated.

1.2 Field of application

1.2.1 Types of noise

This International Standard applies primarily to sources which produce steady broad-band noise as defined in ISO 2204.

NOTE — If discrete frequencies or narrow bands of noise are present in the spectrum of a source, the mean-square sound pressure tends to be highly dependent on the positions of the source and the microphone within the room. The average value over a limited microphone path or array may differ significantly from the value averaged over all points in the room. Procedures for determining the sound power radiated by a source when discrete tones are present in the spectrum are described in ISO 3742.

1.2.2 Size of source

This International Standard applies only to small noise sources, i.e. sources with volumes which are preferably not greater than 1 % of the volume of the reverberation room used for the test.

1.3 Measurement uncertainty

Measurements made in conformity with this International Standard tend to result in standard deviations which are equal to or less than those given in table 2. The standard deviations given in table 2 take into account the cumulative effects of all causes of measurement uncertainty.

Table 2 — Uncertainty in determining sound power levels of broad-band noise sources in reverberation rooms

Octave-band centre frequencies	One-third octave-band centre frequencies	Standard deviation
Hz	Hz	dB
125	100 to 160	3
250	200 to 315	2
500 to 4 000	400 to 5 000	1,5
8 000	6 300 to 10 000	3

NOTES

1 The standard deviations given in table 2 are measures of the uncertainties associated with the test methods defined in this International Standard. If a stable source of steady broad-band noise were transported to each of a large number of laboratories, and if, at each laboratory, the sound power level of that source were measured in accordance with the provisions of this International Standard, the standard deviation, as a function of frequency, of these many sound power level calculations could be calculated. If a similar inter-laboratory series of measurements were carried out on each of a large number of different specimens of the same type of stable sources of steady broad-band, it would be possible to calculate overall standard deviations that would correspond to the random selection of a noise source and the random selection of a laboratory. It is these standard deviations which have been estimated and given in table 2.

2 If two laboratories use similar facilities and instrumentation, the results of sound power level determinations on a given source in these laboratories may be in better agreement than would be inferred from the standard deviations in table 2.

3 For a particular family of noise sources, of similar size and with similar sound spectra, the standard deviations of sound power level determinations in different laboratories may be significantly smaller than the values given in table 2. Thus, a test code for a particular type of machinery may state standard deviations smaller than those given in table 2 if the results of inter-laboratory tests are available to substantiate the smaller values.

4 The largest sources of uncertainty, other than possible deviations from the theoretical model (direct method) and errors in the calibration of the reference sound source (comparison method), in the test methods specified in this International Standard are associated with inadequate sampling of the sound field and with variations in the acoustic coupling from the noise source to the sound field (for different test rooms and for different positions within a test room). In any laboratory, it may be possible to reduce measurement uncertainty by one or more of the following procedures:

a) use of multiple source locations;

b) improvement of spatial sampling of the sound field;

c) addition of low-frequency sound absorbers to improve modal overlap;

d) use of moving diffuser elements.

In addition, a large reverberation room may be used to reduce uncertainties at low frequencies although the precision of high-frequency sound power level determinations may be degraded. Conversely, a small room may lead to reduced high-frequency uncertainties but increased low-frequency uncertainties. Thus, if improved precision is needed, and if two reverberation rooms are available, it may be desirable to carry out the low-frequency sound power level determinations in the larger room and high-frequency determinations in the smaller room.

2 References

ISO 266, *Acoustics — Preferred frequencies for measurements.*

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

ISO 2204, *Acoustics — Guide to International Standards on the measurement of airborne acoustical noise and evaluation of its effects on human beings.*

ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards and for the preparation of noise test codes.*

ISO 3742, *Acoustics — Determination of sound power levels of noise sources — Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.*

ISO 3743, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for special reverberation test rooms.*