



SLOVENSKI STANDARD oSIST prEN ISO 3746:2006

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Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane (ISO/DIS 3746:2005)

Akustik - Ermittlung der Schalleistungs- und der Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen - Hüllflächenverfahren der Genauigkeitsklasse 3 über einer reflektierenden Ebene (ISO/DIS 3746:2005)

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Acoustique - Détermination des niveaux de puissance acoustique et des niveaux d'énergie acoustique a partir de la pression acoustique - Méthode de contrôle employant une surface de mesure enveloppante au-dessus d'un plan réfléchissant (ISO/DIS 3746:2005)

Ta slovenski standard je istoveten z: prEN ISO 3746

ICS:

17.140.01 OE`•cā } aĀ ^!b } bāā Acoustic measurements and
à|æ^ } b^@`] aĀ aĀ] [z] [noise abatement in general

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November 2005

ICS

Will supersede EN ISO 3746:1995

English Version

Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane (ISO/DIS 3746:2005)

Acoustique - Détermination des niveaux de puissance acoustique et des niveaux d'énergie acoustique à partir de la pression acoustique - Méthode de contrôle employant une surface de mesure enveloppante au-dessus d'un plan réfléchissant (ISO/DIS 3746:2005)

This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 211.

If this draft becomes a European Standard, 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.

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Foreword

This document (prEN ISO 3746:2005) has been prepared by Technical Committee ISO/TC 43 "Acoustics" in collaboration with Technical Committee CEN/TC 211 "Acoustics", the secretariat of which is held by DS.

This document is currently submitted to the parallel Enquiry.

This document will supersede EN ISO 3746:1995.

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(s).

Endorsement notice

The text of ISO 3746:2005 has been approved by CEN as prEN ISO 3746:2005 without any modifications.

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Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane

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[Revision of second edition (ISO 3746:1995 and ISO 3746:1995/Cor 1:1995)]

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The CEN Secretary-General has advised the ISO Secretary-General that this ISO/DIS covers a subject of interest to European standardization. **In accordance with the ISO-lead mode of collaboration as defined in the Vienna Agreement, consultation on this ISO/DIS has the same effect for CEN members as would a CEN enquiry on a draft European Standard.** Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month FDIS vote in ISO and formal vote in CEN.

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Foreword

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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 3746 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1.

This third edition cancels and replaces the second edition (ISO 3746:1995), which has been technically revised.

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Introduction

0.1 This International Standard is one of the series ISO 3740 to ISO 3747, that specifies methods to determine the emitted sound power level and sound energy level of noise sources including machinery, equipment and their sub-assemblies. Guidelines to select one of those methods are provided in ISO 3740:2001. The selection will depend on the environment of the available test facility and on the precision of the sound power level or sound energy level values required. It may be necessary to establish a test code for the individual noise source in order to select the appropriate sound measurement surface and microphone array from among those allowed in each standard, and to give requirements on test unit mounting, loading and operating conditions under which the sound power levels or sound energy levels are to be obtained. The sound power emitted by a given source into the test environment is calculated from the mean square sound pressure that is measured over a hypothetical measurement surface enclosing the source, and the area of that surface. The sound energy for a single machine event is calculated from this sound power and the time over which it existed.

0.2 This International Standard provides a survey grade of accuracy (grade 3) as defined in ISO 12001 when performed within industrial buildings or outdoors. Ideally, the test source should be mounted on a sound reflecting plane located in a large open space. For sources normally installed on the floor of machine rooms, corrections are defined to account for undesired reflections from nearby objects, walls and the ceiling, and for the residual background noises that occur there.

0.3 The method specified in this International Standard permits the determination of the sound power level and the sound energy level with frequency weighting 'A' applied.

0.4 For applications where greater accuracy is required, reference can be made to ISO 3744, ISO 3745 or an appropriate part of ISO 9614. If the relevant criteria for the measurement environment specified in this International Standard are not met, it might be possible to refer to another standard from this series, or to an appropriate part of ISO 9614.

0.5 This International Standard cancels and replaces ISO 3746:1995.

Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane

1 Scope

1.1 General

This International Standard specifies methods determining the sound power levels of a noise source from sound pressure levels measured on a surface enveloping a noise source (machinery or equipment) in a test environment for which requirements are given. The sound power level (or, in the case of noise bursts or transient noise emission, the sound energy level) produced by the noise source, with frequency-weighting A applied, is calculated using those measurements.

NOTE Differently shaped measurement surfaces can yield differing estimates of the sound power level of a given noise source and a test code should give detailed information on the selection of the surface.

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.

This International Standard is applicable to all types and sizes of noise source (e.g. stationary or slowly moving plant, installation, machine, component or sub-assembly), provided the conditions for the measurements can be met.

NOTE The conditions for measurements given in this International Standard could be impracticable for very tall or very long sources such as chimneys, ducts, conveyors and multi-source industrial plants. A test code for the determination of noise emission of specific sources can provide alternative methods in such cases.

1.3 Test environment

The test environments that are applicable for measurements made in accordance with this International Standard may be located indoors or outdoors, with one or more sound-reflecting planes present on or near which the noise source under test is mounted.

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 with frequency weighting A applied. The uncertainty conforms with that of the survey grade of accuracy (grade 3) defined in ISO 12001.

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 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

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

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

IEC 60942:2003, *Electroacoustics – Sound calibrators*

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

Guide to the expression of uncertainty in measurement (GUM). International Organization for Standardization, Geneva, Switzerland. ISBN 92-67-10188-9, First Edition 1993, corrected and reprinted 1995.

3 Terms and definitions

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

3.1 sound pressure

p
a fluctuating pressure superimposed on the static pressure by the presence of sound, 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

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

The reference value, p_0 , is 20 μPa (2×10^{-5} Pa).

3.3 time-averaged sound pressure level

$L_{p,T}$
level of the time-averaged square of the sound pressure over the measurement time interval T , expressed in decibels

$$L_{p,T} = 10 \lg \left[\frac{1}{T} \int_0^T \frac{p^2(t)}{p_0^2} dt \right] \text{ dB} \quad (2)$$

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} .

3.4 single-event sound pressure level

L_E

level of the time-integrated square of the sound pressure of an isolated single sound event (burst of sound or transient sound) of specified duration T (or specified measurement time interval $T = t_2 - t_1$) normalized to reference time interval $T_0 = 1$ s, expressed in decibels

$$L_E = 10 \lg \left[\frac{1}{T_0} \int_{t_1}^{t_2} \frac{p^2(t)}{p_0^2} dt \right] \text{dB} = L_{p,T} + 10 \lg \left[\frac{T}{T_0} \right] \text{dB} \quad (3)$$

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, expressed in seconds

3.6 reflecting plane

reflecting planar surface on which the noise source under test is located

3.7 frequency range of interest

the range of octave bands with nominal midband frequencies from 125 Hz to 8000 Hz

3.8 reference box

hypothetical rectangular parallelepiped terminating on the reflecting plane(s) on which the noise source under test is located, that just encloses the source including all the significant sound radiating components and any test table on which the source is mounted (see 6.3)

3.9 characteristic source dimension

d_0

distance from the origin of the co-ordinate system to the farthest corner of the reference box (see 7.1), expressed in metres

3.10 measurement distance

d

distance from the reference box to a parallelepiped measurement surface, expressed in metres

3.11 measurement radius

r

radius of a hemispherical measurement surface, expressed in metres

3.12 measurement surface

hypothetical surface of area S , on which the microphone positions are located at which the sound pressure levels are measured, enveloping the noise source under test and terminating on the reflecting plane(s) on which the source is located

3.13 background noise

noise from all sources other than the noise source under test

NOTE Background noise may include contributions from airborne sound, structure-borne vibration, and electrical noise in the instrumentation.

**3.14
background noise correction**

K_1
correction applied to the mean (energy-average) of the time-averaged sound pressure levels at all the microphone positions on the measurement surface, to account for the influence of background noise, expressed in decibels

NOTE The background noise correction is frequency dependent, and in the case of A-weighting is denoted K_{1A} .

**3.15
environmental correction**

K_2
correction applied to the mean (energy-average) of the time-averaged sound pressure levels at all the microphone positions on the measurement surface, to account for the influence of reflected or absorbed sound, expressed in decibels

NOTE 1 The environmental correction is frequency dependent, and in the case of A-weighting is denoted K_{2A} .

NOTE 2 In general, the environmental correction depends on the area of the measurement surface and usually K_2 increases with S .

**3.16
surface time-averaged sound pressure level**

$\overline{L_p}$
mean (energy average) of the time-averaged sound pressure levels at all the microphone positions on the measurement surface, with the background noise correction, K_1 , and the environmental correction, K_2 , applied, expressed in decibels

**3.17
surface single-event sound pressure level**

$\overline{L_E}$
mean (energy average) of the single-event sound pressure levels at all the microphone positions on the measurement surface, with the background noise correction, K_1 , and the environmental correction, K_2 , applied, expressed in decibels

**3.18
sound power**

W
rate per unit time at which airborne sound energy is radiated by a source, expressed in watts

**3.19
sound power level**

L_W
ten times the logarithm to the base 10 of the ratio of the sound power of a source, W , to a reference value, W_0 , expressed in decibels

$$L_W = 10 \lg \frac{W}{W_0} \text{ dB} \quad (4)$$

The reference value, W_0 , is 1 pW (10^{-12} W).

NOTE The frequency weighting is indicated in the symbol, so the A-weighted sound power level is L_{WA} .

**3.20
sound energy**

J
energy of a single burst of sound or transient sound emitted by a source, expressed in joules

3.21 sound energy level

L_J

ten times the logarithm to the base 10 of the ratio of the sound energy of a source, J , to a reference value, J_0 , expressed in decibels

$$L_J = 10 \lg \frac{J}{J_0} \text{ dB} \quad (5)$$

The reference value, J_0 , is 1 pJ (10^{-12} J).

NOTE The frequency weighting is indicated in the symbol, so the A-weighted sound energy level is L_{JA} .

4 Test environment

4.1 General

The test environments that are applicable for measurements according to this International Standard are a room or a flat outdoor area which is adequately isolated from background noise (see 4.2) and which meets the qualification requirements of 4.3.

Environmental conditions having an adverse effect on the microphones used for the measurements (for example, strong electric or magnetic fields, wind, impingement of air discharge from the noise source being tested, high or low temperatures) shall be avoided. The instructions of the manufacturers of the measuring instrumentation regarding adverse environmental conditions shall be followed.

In an outdoor area, care shall be taken to minimize the effects of adverse meteorological conditions (for example, temperature, humidity, wind, precipitation) on the sound propagation and on the sound generation over the frequency range of interest or on the background noise during the course of the measurements.

At altitudes exceeding 1500 m sound power levels and sound energy levels shall be corrected to reference meteorological conditions according to ISO 3744.

NOTE When a reflecting surface is not a ground plane or is not an integral part of a test room surface, particular care should be exercised to ensure that the plane does not radiate any appreciable sound due to vibrations.

4.2 Criterion for background noise

The A-weighted sound pressure levels due to background noise averaged over the microphone positions on the measurement surface shall be at least 3 dB below the mean sound pressure level due to the noise source under test (see 8.3.2).

4.3 Criterion for acoustic adequacy of test environment

Annex A describes procedures for determining the magnitude of the environmental correction, K_{2A} , to account for deviations of the test environment from the ideal condition. Measurements according to this International Standard are only valid where K_{2A} is numerically less than or equal to 7 dB (see 8.1).

NOTE 1 If the environmental correction K_{2A} exceeds 7 dB, ISO 3747, ISO 9614-1 or ISO 9614-2 may be used.

NOTE 2 In some specific cases, the horizontal plane is only partially reflecting (e.g. lawnmowers, some types of earth-moving machines). In such cases, the relevant noise test code should describe in detail the nature of the plane on which the source is mounted and indicate the possible consequences on the measurement uncertainty.