

**SLOVENSKI STANDARD**  
**SIST EN ISO 3747:2011****01-marec-2011****Nadomešča:****SIST EN ISO 3747:2009**

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**Akustika - Določanje ravni zvočnih moči in in ravni zvočne energije virov hrupa z zvočnim tlakom - Inženirska/informativna metoda za uporabo na kraju samem (in situ) v odmevnem okolju (ISO 3747:2010)**

Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering/survey methods for use in situ in a reverberant environment (ISO 3747:2010)

Akustik - Bestimmung der Schalleistungs- und Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen - Verfahren der Genauigkeitsklassen 2 und 3 zur Anwendung in situ in einer halligen Umgebung (ISO 3747:2010)

Acoustique - Détermination des niveaux de puissance acoustique et des niveaux d'énergie acoustique émis par les sources de bruit à partir de la pression acoustique - Méthode d'expertise et de contrôle pour une utilisation in situ en environnement réverbérant (ISO 3747:2010)

**Ta slovenski standard je istoveten z: EN ISO 3747:2010**

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**ICS:**

17.140.01	Akustična merjenja in blaženje hrupa na splošno	Acoustic measurements and noise abatement in general
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**SIST EN ISO 3747:2011****en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN ISO 3747**

December 2010

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Supersedes EN ISO 3747:2009

English Version

**Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering/survey methods for use in situ in a reverberant environment (ISO 3747:2010)**

Acoustique - Détermination des niveaux de puissance acoustique et des niveaux d'énergie acoustique émis par les sources de bruit à partir de la pression acoustique - Méthode d'expertise et de contrôle pour une utilisation in situ en environnement réverbérant (ISO 3747:2010)

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This European Standard was approved by CEN on 6 November 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-CENELEC Management Centre has the same status as the official versions.

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## Foreword

This document (EN ISO 3747:2010) 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 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 June 2011, and conflicting national standards shall be withdrawn at the latest by June 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 3747:2009.

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(s).

For relationship with EU Directive(s), 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.

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### Endorsement notice

The text of ISO 3747:2010 has been approved by CEN as a EN ISO 3747:2010 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 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 Union 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 corresponding 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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# INTERNATIONAL STANDARD

**ISO**  
**3747**

Third edition  
2010-12-01

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## **Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering/survey methods for use *in situ* in a reverberant environment**

*Acoustique — Détermination des niveaux de puissance acoustique et  
des niveaux d'énergie acoustique émis par les sources de bruit à partir  
de la pression acoustique — Méthode d'expertise et de contrôle pour  
une utilisation in situ en environnement réverbérant*

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**ISO 3747:2010(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. 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 3747 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This third edition cancels and replaces the second edition (ISO 3747:2000), which has been technically revised.

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## Introduction

This International Standard is one of the series ISO 3741<sup>[2]</sup> to ISO 3747, 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<sup>[1]</sup>. ISO 3740<sup>[1]</sup> to ISO 3747 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 method given in this International Standard is based on a comparison of the sound pressure levels in octave frequency bands of a noise source under test with those of a calibrated reference sound source; A-weighted sound power levels or sound energy levels may be calculated from the octave-band levels. The method is applied where the noise source is found *in situ* and as such is suitable for larger pieces of stationary equipment which, due to their manner of operation or installation, cannot readily be moved.

The method specified in this International Standard permits the determination of the sound power level and the sound energy level in octave bands from which the A-weighted value is calculated.

This International Standard describes a method giving results of either ISO 12001:1996, accuracy grade 2 (engineering grade) or ISO 12001:1996, accuracy grade 3 (survey grade), depending on the extent to which the requirements concerning the test environment are met. For applications where greater accuracy is required, reference can be made to ISO 3741<sup>[2]</sup>, ISO 3744<sup>[5]</sup> or an appropriate part of ISO 9614<sup>[17]-[19]</sup>. 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<sup>[17]-[19]</sup>.

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# Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering/survey methods for use *in situ* in a reverberant environment

## 1 Scope

### 1.1 General

This International Standard specifies a method for determining the sound power level or sound energy level of a noise source by comparing measured sound pressure levels emitted by a noise source (machinery or equipment) mounted *in situ* in a reverberant environment, with those from a calibrated reference sound source. 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 octave, is calculated using those measurements. The sound power level or sound energy level with frequency A-weighting applied is calculated using the octave-band levels.

### 1.2 Types of noise and noise sources

The method specified in this International Standard is suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001-4. The method is primarily applicable to sources which emit broad-band noise. It can, however, also be used for sources which emit narrow-band noise or discrete tones, although there is a possibility that the measurement reproducibility is then degraded.

The noise source under test can be a device, machine, component or sub-assembly, especially one which is non-movable.

### 1.3 Test environment

The test environment that is applicable for measurements made in accordance with this International Standard is a room where the sound pressure level at the microphone positions depends mainly on reflections from the room surfaces (see 4.1). In measurements of ISO 12001:1996, accuracy grade 2 (engineering grade), background noise in the test environment is low compared to that of the noise source or reference sound source (see 4.2).

### 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 octave bands and for A-weighted frequency calculations performed on them. The uncertainty conforms with that of either ISO 12001:1996, accuracy grade 2 (engineering grade) or ISO 12001:1996, accuracy grade 3 (survey grade), depending on the extent to which the requirements concerning the test environment are met.

## ISO 3747:2010(E)

## 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 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 used 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 of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

IEC 60942:2003, *Electroacoustics — Sound calibrators*

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 definitions apply:

### 3.1

#### sound pressure

$p$   
difference between instantaneous pressure and static pressure

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NOTE 1 Adapted from ISO 80000-8:2007<sup>[22]</sup>, 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  $\mu\text{Pa}$

[ISO/TR 25417:2007<sup>[21]</sup>, 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<sup>[22]</sup>, 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

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

where the reference value,  $p_0$ , is 20  $\mu\text{Pa}$

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<sup>[21]</sup>, 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

$$L_E = 10 \lg \left[ \frac{\int_{t_1}^{t_2} p^2(t) dt}{E_0} \right] \text{ dB} \quad (3)$$

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  $L_{p,T} + 10 \lg(T/T_0)$  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<sup>[21]</sup>).

### 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.

### 3.6 comparison method

method by which the sound power level or sound energy level of a noise source under test is determined from a comparison of the sound pressure levels produced by the source under test with those of a reference sound source of known sound power output, when both sources are operated in the same environment