

**Akustika. Mürasallikate helivõimsuse taseme määramine  
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vabas väljas peegeltasapinna kohal**

Acoustics - Determination of sound power levels of noise  
sources using sound pressure - Engineering method in an  
essentially free field over a reflecting plane

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 3744:2009 sisaldab Euroopa standardi EN ISO 3744:2009 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 30.09.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

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This Estonian standard EVS-EN ISO 3744:2009 consists of the English text of the European standard EN ISO 3744:2009.

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English Version

Acoustics - Determination of sound power levels of noise sources using sound pressure - Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)

Acoustique - Détermination des niveaux de puissance acoustique émis par les sources de bruit à partir de la pression acoustique - Méthode d'expertise dans des conditions approchant celles du champ libre sur plan réfléchissant (ISO 3744:1994)

Akustik - Bestimmung der Schalleistungspegel von Geräuschquellen aus Schalldruckmessungen - Hüllflächenverfahren der Genauigkeitsklasse 2 für ein im wesentlichen freies Schallfeld über einer reflektierenden Ebene (ISO 3744:1994)

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

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Management Centre: Avenue Marnix 17, B-1000 Brussels

## Foreword

The text of ISO 3744:1994 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 3744:2009 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of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.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 3744:1995.

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 EC Directives.

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

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### Endorsement notice

The text of ISO 3744:1994 has been approved by CEN as a EN ISO 3744:2009 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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## 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 purposes of the noise test. General guidelines to assist in the selection are provided in 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 a method for measuring the sound pressure levels on a measurement surface enveloping the source, and for calculating the sound power level produced by the source. The enveloping surface method can be used for any of three grades of accuracy (see table 0.1), and is used in this International Standard for grade 2 accuracy.

The use of this International Standard requires certain qualification criteria to be fulfilled, as described in table 0.1. If the relevant qualification criteria cannot be met, other basic standards with different environmental requirements are suggested (table 0.1; see also ISO 3740 and ISO 9614).

Noise test codes for specific families of machines or equipment should be based without any contradiction on the requirements of one or more of the ISO 3740 series or ISO 9614.

Free-field conditions are usually not encountered in typical machine rooms where sources are normally installed. If measurements are made in such installations, corrections may be required to account for background noise or undesired reflections.

The methods specified in this International Standard permit the determination of sound power level both as an A-weighted value and in frequency bands.

The A-weighted value calculated from frequency band data may differ from that determined from measured A-weighted sound pressure levels.

**0.3** In this International Standard, the computation of sound power level from sound pressure level measurements is based on the premise that the sound power output of the source is directly proportional to the mean-square sound pressure averaged over time and space.

**Table 0.1 — Overview of International Standards for determination of sound power levels of noise sources using enveloping surface methods over a reflecting plane and giving different grades of accuracy**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                | ISO 3745<br>Precision<br>method<br>Grade 1                                                                   | ISO 3744<br>Engineering<br>method<br>Grade 2                                                                 | ISO 3746<br>Survey<br>method<br>Grade 3                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test environment                                                                                                                                                                                                                                                                                                                                                                                                                         | Hemi-anechoic room                                                                                           | Outdoors or indoors                                                                                          | Outdoors or indoors                                                                                                                                                                  |
| Criterion for suitability of test environment <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                              | $K_2 \leq 0,5$ dB                                                                                            | $K_2 \leq 2$ dB                                                                                              | $K_2 \leq 7$ dB                                                                                                                                                                      |
| Volume of sound source                                                                                                                                                                                                                                                                                                                                                                                                                   | Preferably less than 0,5 % of test room volume                                                               | No restriction; limited only by available test environment                                                   | No restriction; limited only by available test environment                                                                                                                           |
| Character of noise                                                                                                                                                                                                                                                                                                                                                                                                                       | Any (broad-band, narrow-band, discrete-frequency, steady, non-steady, impulsive)                             |                                                                                                              |                                                                                                                                                                                      |
| Limitation for background noise <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                            | $\Delta L \geq 10$ dB (if possible, exceeding 15 dB)<br>$K_1 \leq 0,4$ dB                                    | $\Delta L \geq 6$ dB (if possible, exceeding 15 dB)<br>$K_1 \leq 1,3$ dB                                     | $\Delta L \geq 3$ dB<br>$K_1 \leq 3$ dB                                                                                                                                              |
| Number of measurement points                                                                                                                                                                                                                                                                                                                                                                                                             | $\geq 10$                                                                                                    | $\geq 9$ <sup>2)</sup>                                                                                       | $\geq 4$ <sup>2)</sup>                                                                                                                                                               |
| Instrumentation:<br>— Sound level meter at least complying with<br>— Integrating sound level meter at least complying with<br>— Frequency band filter set at least complying with                                                                                                                                                                                                                                                        | a) type 1 as specified in IEC 651<br>b) type 1 as specified in IEC 804<br>c) class 1 as specified in IEC 225 | a) type 1 as specified in IEC 651<br>b) type 1 as specified in IEC 804<br>c) class 1 as specified in IEC 225 | a) type 2 as specified in IEC 651<br>b) type 2 as specified in IEC 804<br>—                                                                                                          |
| Precision of method for determining $L_{WA}$ expressed as standard deviation of reproducibility                                                                                                                                                                                                                                                                                                                                          | $\sigma_R \leq 1$ dB                                                                                         | $\sigma_R \leq 1,5$ dB                                                                                       | $\sigma_R \leq 3$ dB (if $K_2 < 5$ dB)<br>$\sigma_R \leq 4$ dB (if $5 \text{ dB} \leq K_2 \leq 7$ dB)<br>If discrete tones are predominant, the value of $\sigma_R$ is 1 dB greater. |
| <p>1) The values of <math>K_1</math> and <math>K_2</math> given shall be met in each frequency band within the frequency range of interest for determining the sound power spectrum. For determining A-weighted sound power levels, the same criteria apply to <math>K_{1A}</math> and <math>K_{2A}</math>.</p> <p>2) Under given circumstances (see 7.2 to 7.4), it is permissible to use a reduced number of microphone positions.</p> |                                                                                                              |                                                                                                              |                                                                                                                                                                                      |

# Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane

## 1 Scope

### 1.1 General

This International Standard specifies a method for measuring the sound pressure levels on a measurement surface enveloping a noise source, under essentially free-field conditions near one or more reflecting planes, in order to calculate the sound power level produced by the noise source. It gives requirements for the test environment and instrumentation, as well as techniques for obtaining the surface sound pressure level from which the sound power level of the source is calculated, leading to results which have a grade 2 accuracy.

It is important that specific noise test codes for various types of equipment be established and used in accordance with this International Standard. For each type of equipment, such noise test codes will give detailed requirements on mounting, loading and operating conditions for the equipment under test as well as a selection of the measurement surface and the microphone array as specified in this International Standard.

NOTE 1 The noise test code for a particular type of equipment should give detailed information on the particular surface that is selected, as the use of differently shaped measurement surfaces may yield differing estimates of the sound power level of a source.

### 1.2 Types of noise and noise sources

The method specified in this International Standard is suitable for measurements of all types of noise.

NOTE 2 A classification of different types of noise (steady, non-steady, quasi-steady, impulsive, etc.) is given in ISO 2204.

This International Standard is applicable to noise sources of any type and size (e.g. device, machine, component, sub-assembly).

NOTE 3 Measurements according to this International Standard may be impracticable for very tall or very long sources such as chimneys, ducts, conveyors and multi-source industrial plants.

### 1.3 Test environment

The test environment that is applicable for measurements made in accordance with this International Standard is an essentially free field near one or more reflecting planes (indoors or outdoors).

### 1.4 Measurement uncertainty

Determinations made in accordance with this International Standard result, with few exceptions, in standard deviations of reproducibility of the A-weighted sound power level equal to or less than 1,5 dB (see table 1).

A single value of the sound power level of a noise source determined according to the procedures given in this International Standard is likely to differ from the true value by an amount within the range of the measurement uncertainty. The uncertainty in determinations of the sound power level arises from several factors which affect the results, some associated with environmental conditions in the measurement laboratory and others with experimental techniques.

If a particular noise source were to be transported to each of a number of different laboratories and if, at each laboratory, the sound power level of that source were to be determined in accordance with this International Standard, the results would show a scatter. The standard deviation of the measured levels could be calculated (see examples in ISO 7574-4:1985, an-