

DIN EN ISO 3744



ICS 17.140.01

Supersedes
DIN EN ISO 3744:2009-11**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 3744:2010)****English translation of DIN EN ISO 3744:2011-02****Akustik –****Bestimmung der Schallleistungs- und Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen –****Hüllflächenverfahren der Genauigkeitsklasse 2 für ein im Wesentlichen freies Schallfeld über einer reflektierenden Ebene (ISO 3744:2010)****Englische Übersetzung von DIN EN ISO 3744:2011-02****Acoustique –****Détermination des niveaux de puissance et d'énergie acoustiques émis par les sources de bruit à partir de la pression acoustique –****Méthodes d'expertise pour des conditions approchant celles du champ libre sur plan réfléchissant (ISO 3744:2010)****Traduction anglaise de DIN EN ISO 3744:2011-02**

Document comprises 87 pages

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original shall be considered authoritative.



A comma is used as the decimal marker.

National foreword

This standard has been prepared by Technical Committee ISO/TC 43 “Acoustics”, Subcommittee SC 1 “Noise” (Secretariat: DS, Denmark), Working Group WG 28 “Basic machinery noise emission standards” in collaboration with Technical Committee CEN/TC 211 “Acoustics” (Secretariat: DS, Denmark).

The responsible German body involved in its preparation was the *Normenausschuss Akustik, Lärminderung und Schwingungstechnik im DIN und VDI* (Acoustics, Noise Control and Vibration Engineering Standards Committee in DIN and VDI), Working Committee NA 001-01-04 AA *Geräuschemission von Maschinen und Anlagen; Messung, Minderung, Datensammlung*.

The DIN Standards corresponding to the International Standards referred to in this document are as follows:

ISO 3382-2	DIN EN ISO 3382-2	ISO 7574-4	DIN EN 27574-4
ISO 3740	DIN EN ISO 3740	ISO 9614-1	DIN EN ISO 9614-1
ISO 3741	DIN EN ISO 3741	ISO 9614-2	DIN EN ISO 9614-2
ISO 3743-1	DIN EN ISO 3743-1	ISO 9614-3	DIN EN ISO 9614-3
ISO 3743-2	DIN EN ISO 3743-2	ISO 10534-1	DIN EN ISO 10534-1
ISO 3745	DIN EN ISO 3745	ISO 10534-2	DIN EN ISO 10534-2
ISO 3746	DIN EN ISO 3746	ISO 11201	DIN EN ISO 11201
ISO 3747	DIN EN ISO 3747	ISO 12001	DIN EN ISO 12001
ISO 4871	DIN EN ISO 4871	ISO 13472-1	DIN ISO 13472-1
ISO 5725 (all parts)	DIN ISO 5725 (all parts)	ISO 80000-8	DIN EN ISO 80000-8
ISO 6926	DIN EN ISO 6926	IEC 60942	DIN EN 60942
ISO 7574-1	DIN EN 27574-1	IEC 61260	DIN EN 61260
ISO 7574-2	DIN EN 27574-2	IEC 61672-1	DIN EN 61672-1
ISO 7574-3	DIN EN 27574-3	ISO/IEC Guide 98-3	DIN V ENV 13005

The national standards are given in Annex NA “Bibliography”.

Amendments

This standard differs from DIN EN ISO 3744:2009-11 as follows:

- specifications relating to absolute criteria for background noise have been included;
- the maximum permissible environmental correction has been changed from 2 dB to 4 dB;
- the determination of sound energy levels has been included;
- specifications relating to the measurement uncertainty have been extended and a GUM-based approach has been included;
- for the determination of the environmental correction based on room absorption, the absorption area can alternatively be determined with a reference sound source;
- the preferred microphone positions on the hemispherical measurement surface, suitable for all noise sources, have been modified;

- g) specifications relating to microphone positions on a quarter-hemispherical measurement surface (sound source located in a corner) have been included;
- h) an alternative array of microphone positions on the parallelepiped measurement surface has been added;
- i) specifications on microphone arrays on a cylindrical measurement surface have been included;
- j) Annex F “Alternative microphone array on a hemispherical measurement surface for direct measurements of A-weighted sound pressure levels” has been added;
- k) Annex G “Sound power level and sound energy level under reference meteorological conditions” has been added;
- l) Annex H “Guidelines on the development of information on measurement uncertainty” has been added;
- m) the standard has been editorially revised.

Previous editions

DIN 45635: 1970-03

DIN 45635-1: 1972-01, 1984-04

DIN EN ISO 3744: 1995-11, 2009-11

National Annex NA (informative)

Bibliography

DIN V ENV 13005, *Guide to the expression of uncertainty in measurement*

DIN EN 27574-1, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 1: General considerations and definitions*

DIN EN 27574-2, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 2: Methods for stated values for individual machines*

DIN EN 27574-3, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 3: Simple (transition) method for stated values for batches of machines*

DIN EN 27574-4, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 4: Methods for stated values for batches of machines*

DIN EN 60942, *Electroacoustics — Sound calibrators*

DIN EN 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*

DIN EN 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

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

DIN EN ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards*

DIN EN ISO 3741, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms*

DIN EN ISO 3743-1, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for small, movable sources in reverberant fields — Part 1: Comparison method for hard-walled test rooms*

DIN EN ISO 3743-2, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering methods for small, movable sources in reverberant fields — Part 2: Methods for special reverberation test rooms*

DIN EN ISO 3745, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for anechoic and hemi-anechoic rooms*

DIN EN ISO 3746, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

DIN EN ISO 3747, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Comparison method for use in situ*

DIN EN ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

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

DIN EN ISO 9614-1, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points*

DIN EN ISO 9614-2, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning*

DIN EN ISO 9614-3, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 3: Precision method for measurement by scanning*

DIN EN ISO 10534-1, *Acoustics — Determination of sound absorption coefficient and impedance in impedance tubes — Part 1: Method using standing wave ratio*

DIN EN ISO 10534-2, *Acoustics — Determination of sound absorption coefficient and impedance in impedance tubes — Part 2: Transfer-function method*

DIN EN ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

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

DIN EN ISO 80000-8, *Quantities and units — Part 8: Acoustics*

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

DIN ISO 13472-1, *Acoustics — Measurement of sound absorption properties of road surfaces in situ — Part 1: Extended surface method*

English Version

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 3744:2010)

Acoustique - Détermination des niveaux de puissance et d'énergie acoustiques émis par les sources de bruit à partir de la pression acoustique - Méthodes d'expertise pour des conditions approchant celles du champ libre sur plan réfléchissant (ISO 3744:2010)

Akustik - Bestimmung der Schalleistungs- und Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen - Hüllflächenverfahren der Genauigkeitsklasse 2 für ein im Wesentlichen freies Schallfeld über einer reflektierenden Ebene (ISO 3744:2010)

This European Standard was approved by CEN on 14 August 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 3744:2010 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 3744:2010 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 3744:2009.

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 3744:2010 has been approved by CEN as a EN ISO 3744:2010 without any modification.

Introduction

This International Standard is one of the series ISO 3741^[2] to ISO 3747^[6], which specify various methods for determining the sound power levels and sound energy levels of noise sources including machinery, equipment and their sub-assemblies. General guidelines to assist in the selection are provided in ISO 3740^[1]. The selection depends 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 noise test code (see ISO 12001) for the individual noise source in order to select the appropriate sound measurement surface and microphone array from among those allowed in each member of the ISO 3741^[2] to ISO 3747^[6] series, 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 sound event is calculated from this sound power and the time over which it existed.

The methods specified in this International Standard permit the determination of the sound power level and the sound energy level in frequency bands optionally with frequency A-weighting applied.

For applications where greater accuracy is required, reference can be made to ISO 3745, ISO 3741^[2] or ISO 9614^{[13]-[15]}. 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 ISO 9614^{[13]-[15]}.

This International Standard describes methods of accuracy grade 2 (engineering grade) as defined in ISO 12001, when the measurements are performed in a space that approximates an acoustically free field over a reflecting plane. Such an environment can be found in a specially designed room, or 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.

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 on a surface enveloping the noise source (machinery or equipment) in an environment that approximates to an acoustic free field near one or more reflecting planes. 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 or with A-weighting 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 an appropriately drafted noise test code (see ISO 12001) gives 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 It is possible that the conditions for measurements given in this International Standard are impracticable for very tall or very long sources such as chimneys, ducts, conveyors and multi-source industrial plants. A noise 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 can be located indoors or outdoors, with one or more sound-reflecting planes present on or near which the noise source under test is mounted. The ideal environment is a completely open space with no bounding or reflecting surfaces other than the reflecting plane(s) (such as that provided by a qualified hemi-anechoic chamber), but procedures are given for applying corrections (within limits that are specified) in the case of environments that are less than ideal.

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 limited bands of frequency and with frequency A-weighting applied. The uncertainty conforms to ISO 12001:1996, accuracy grade 2 (engineering 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 3745, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for anechoic test rooms and hemi- anechoic test 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 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 Pa

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