

SLOVENSKI STANDARD

SIST EN ISO 3745:2012

01-julij-2012

Nadomešča:
SIST EN ISO 3745:2009

Akustika - Ugotavljanje ravni zvočnih moči in ravni zvočne energije virov hrupa z zvočnim tlakom - Precizijska metoda za gluhe in polgluhe prostore (ISO 3745:2012)

Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for anechoic rooms and hemi-anechoic rooms (ISO 3745:2012)

iTeh STANDARD PREVIEW

Akustik - Bestimmung der Schalleistungs- und Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen - Verfahren der Genauigkeitsklasse 1 für reflexionsarme Räume und Halbräume (ISO 3745:2012)

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-43148630e23/sist-en-iso-3745-2012)

[https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-43148630e23/sist-en-iso-3745-2012)

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 - Méthodes de laboratoire pour les salles anéchoïques et les salles semi-anéchoïques (ISO 3745:2012)

Ta slovenski standard je istoveten z: EN ISO 3745:2012

ICS:

17.140.01	Akustična merjenja in blaženje hrupa na splošno	Acoustic measurements and noise abatement in general
91.120.20	Akustika v stavbah. Zvočna izolacija	Acoustics in building. Sound insulation

SIST EN ISO 3745:2012

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN ISO 3745:2012

<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 3745

March 2012

ICS 17.140.01

Supersedes EN ISO 3745:2009

English Version

Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for anechoic rooms and hemi-anechoic rooms (ISO 3745:2012)

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 - Méthodes de laboratoire pour les salles anéchoïques et les salles semi-anéchoïques (ISO 3745:2012)

Akustik - Bestimmung der Schalleistungs- und Schallenergiepegel von Geräuschquellen aus Schalldruckmessungen - Verfahren der Genauigkeitsklasse 1 für reflexionsarme Räume und Halbräume (ISO 3745:2012)

This European Standard was approved by CEN on 14 March 2012.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
Foreword	3
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC	4

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)
<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

Foreword

This document (EN ISO 3745:2012) 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 September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

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 3745:2009.

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, Turkey and the United Kingdom.

SIST EN ISO 3745:2012

<https://standards.iteh.ai/catalog/standards/sist/5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

Endorsement notice

The text of ISO 3745:2012 has been approved by CEN as a EN ISO 3745:2012 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 one means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC, *Machinery directive*.

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 relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)

<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

INTERNATIONAL
STANDARDISO
3745Third edition
2012-03-15

**Acoustics — Determination of sound
power levels and sound energy levels of
noise sources using sound pressure —
Precision methods for anechoic rooms
and hemi-anechoic rooms**

*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 — Méthodes de laboratoire pour les salles
anéchoïques et les salles semi-anéchoïques*

SIST EN ISO 3745:2012

[https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-
d3148630ce13/sist-en-iso-3745-2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)



Reference number
ISO 3745:2012(E)

© ISO 2012

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)

<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2012

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
1.1 General	1
1.2 Types of noise and noise sources	1
1.3 Test room	1
1.4 Measurement uncertainty	1
2 Normative references	1
3 Terms and definitions	2
4 Reference meteorological conditions	7
5 Test rooms	8
5.1 Acoustic criterion for adequacy of the test room	8
5.2 Criteria for background noise	8
5.3 Criterion for air temperature	9
6 Instrumentation	9
6.1 Instruments for acoustical measurements	9
6.2 Instruments for meteorological measurements	11
7 Definition, location, installation and operation of noise source under test	11
7.1 General	11
7.2 Auxiliary equipment	11
7.3 Noise source location	11
7.4 Mounting of the noise source	12
7.5 Operation of source during test	12
8 Measurement surface	13
8.1 Spherical measurement surface for use in an anechoic room	13
8.2 Hemispherical measurement surface for use in a hemi-anechoic room	13
9 Determination of sound power levels and sound energy levels	14
9.1 Measurements in the test room	14
9.2 Measurement of meteorological conditions	14
9.3 Microphone positions	14
9.4 Determination of sound power levels of a noise source which emits steady or non-steady noise	16
9.5 Determination of sound energy levels for a noise source which emits impulsive noise	20
9.6 Calculation of directivity indices	22
9.7 Calculation of surface sound pressure level non-uniformity index	23
9.8 Frequency-weighted sound power level and sound energy level	23
10 Measurement uncertainty	23
10.1 Methodology	23
10.2 Determination of σ_{omc}	24
10.3 Determination of σ_{R0}	24
10.4 Typical upper bound values of σ_{R0}	25
10.5 Total standard deviation, σ_{tot}, and expanded measurement uncertainty, U	26
11 Information to be recorded	27
11.1 General	27
11.2 Noise source under test	27
11.3 Test room	27
11.4 Instrumentation	27
11.5 Acoustical data	27
12 Test report	28

ISO 3745:2012(E)

Annex A (normative) General procedures for qualification of anechoic and hemi-anechoic rooms	29
Annex B (normative) Qualification procedure for spaces within test rooms used in the determination of sound power levels and sound energy levels of specific noise sources	36
Annex C (normative) Calculation of A-weighted sound power levels and A-weighted sound energy levels from one-third-octave band levels	38
Annex D (normative) Array of microphone positions on a spherical measurement surface in a free field	40
Annex E (normative) Arrays of microphone positions on a hemispherical measurement surface in a hemi-free field	43
Annex F (normative) Coaxial circular paths of microphones on a hemispherical measurement surface in a hemi-free field	48
Annex G (normative) Meridional paths of microphones on a hemispherical measurement surface in a hemi-free field	49
Annex H (normative) Spiral paths of microphones on a hemispherical measurement surface in a hemi-free field	51
Annex I (informative) Guidance on the development of information on measurement uncertainty	52
Bibliography	62

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)

<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

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 3745 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This third edition cancels and replaces the second edition (ISO 3745:2003), which has been technically revised.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)

<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

ISO 3745:2012(E)**Introduction**

This International Standard is one of the series ISO 3741^[3] to ISO 3747^[8], 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^[2]. ISO 3741^[3] to ISO 3747^[8] 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 on mounting, loading and operating conditions under which the sound power levels or sound energy levels are to be obtained and to select the appropriate measurement surface and microphone array from among those specified in this International Standard.

The methods given in this International Standard require the source to be mounted in either an anechoic room or a hemi-anechoic room having specified acoustical characteristics. The methods are then based on the premise that the sound power or sound energy of the source is directly proportional to the mean-square sound pressure over a hypothetical measurement surface enclosing the source and otherwise depends on the physical constants of air.

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

The methods give a precision grade of accuracy (grade 1) as defined in ISO 12001. The resulting sound power levels and sound energy levels include corrections to allow for any differences that might exist between the meteorological conditions under which the tests are conducted and reference meteorological conditions. For applications where there are large uncertainties due to operating conditions or where reduced accuracy is acceptable, reference can be made to the more practical methods of ISO 3744^[6] or ISO 3746^[7]. Guidance on evaluation of measurement uncertainty is given in Annex I.

[SIST EN ISO 3745:2012](https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012)

<https://standards.iteh.ai/catalog/standards/sist/a5e03926-0a10-4286-9c78-d3148630ce13/sist-en-iso-3745-2012>

Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for anechoic rooms and hemi-anechoic rooms

1 Scope

1.1 General

This International Standard specifies methods for measuring the sound pressure levels on a measurement surface enveloping a noise source (machinery or equipment) in an anechoic room or a hemi-anechoic room. The sound power level (or, in the case of impulsive or transient noise emission, the sound energy level) produced by the noise source, in frequency bands of width one-third octave or with frequency weighting A applied, is calculated using those measurements, including corrections to allow for any differences between the meteorological conditions at the time and place of the test and those corresponding to a reference characteristic acoustic impedance.

In general, the frequency range of interest includes the one-third-octave bands with mid-band frequencies from 100 Hz to 10 000 Hz. In practice, the range is extended or restricted to frequencies beyond or within these limits, to those between which the test room is qualified for the purposes of the measurements.

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.

The noise source under test can be a device, machine, component or sub-assembly. The maximum size of the noise source depends on specified requirements regarding the radius of the hypothetical sphere or hemisphere used as the enveloping measurement surface.

1.3 Test room

The test rooms that are applicable for measurements made in accordance with this International Standard are an anechoic room or hemi-anechoic room, also called, respectively, a free-field test room or hemi-free-field test room.

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 weighting A applied. The uncertainty conforms to ISO 12001:1996, accuracy grade 1 (precision 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 5725 (all parts), *Accuracy (trueness and precision) of measurement methods and results*

ISO 9613-1:1993, *Acoustics — Attenuation of sound during propagation outdoors — Part 1: Calculation of the absorption of sound by the atmosphere*

ISO 12001:1996, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code*

ISO 3745:2012(E)

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 61183, *Electroacoustics — Random-incidence and diffuse-field calibration of sound level meters*

IEC 61260:1995 + AM1:2001, *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^[22], 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 μPa

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

NOTE 1 If specific frequency and time weightings as specified in IEC 61672-1 and/or specific frequency bands are applied, this should be 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^[22], 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 μPa

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^[20], 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 $(20 \mu\text{Pa})^2 \text{ s} = 4 \times 10^{-10} \text{ Pa}^2 \text{ s}$

[ISO 3741:2010^[3], 3.4]

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 (see ISO 11690-1^[19]), this quantity is usually called “sound exposure level” (see ISO/TR 25417:2007^[20], 2.7).

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.

[ISO 3741:2010^[3], 3.5]

3.6 free sound field

sound field in a homogeneous, isotropic medium free of boundaries

NOTE In practice, a free sound field is a field in which the influence of reflections at the boundaries or other disturbing objects is negligible over the frequency range of interest.

[ISO/TR 25417:2007^[20], 2.17]

3.7 anechoic room anechoic test room free-field test room

test room in which a free sound field is obtained

3.8 free sound field over a reflecting plane

free sound field in the half-space above an infinite reflecting plane in the absence of any other obstacles

3.9 reflecting plane

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