SLOVENSKI STANDARD
oSIST prEN ISO 16032:2023

01-julij-2023

Akustika - Merjenje ravni zvočnega tlaka obratovalne opreme ali aktivnosti v stavbah - Inženirska metoda (ISO/DIS 16032:2023)

Acoustics - Measurement of sound pressure level from service equipment or activities in buildings - Engineering method (ISO/DIS 16032:2023)

Akustik - Messung des Schalldruckpegels von haustechnischen Anlagen oder Aktivitäten in Gebäuden - Standardverfahren (ISO/DIS 16032:2023)

Acoustique - Mesurage du niveau de pression acoustique des équipements techniques ou activités dans les bâtiments - Méthode d'expertise (ISO/DIS 16032:2023)

Ta slovenski standard je istoveten z: **prEN ISO 16032**

ICS:

17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment
91.120.20	Akustika v stavbah. Zvočna izolacija	Acoustics in building. Sound insulation

oSIST prEN ISO 16032:2023 **en,fr,de**

DRAFT INTERNATIONAL STANDARD

ISO/DIS 16032

ISO/TC **43**/SC **2**

Secretariat: **DIN**

Voting begins on:
2023-04-20

Voting terminates on:
2023-07-13

Acoustics — Measurement of sound pressure level from service equipment or activities in buildings — Engineering method

ICS: 91.140.01; 91.120.20; 17.140.20

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 16032:2023(E)

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Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 43/SC 2, Building acoustics.

This second edition cancels and replaces the first edition (ISO 16032:2004), which has been technically revised.

The main changes are as follows:

— The procedure to detect and average temporal variations of the sound has been revised;

— Measurements may be performed to verify sound levels either from a specific service equipment or from unknown sources, in the building or nearby a building;

— Measurements may be performed in one–third–octave–bands or octave–bands;

— Standardization with respect to reverberation times applies to the 50–5 000 Hz third–octave–bands (or 63–4 000 Hz octave–bands);

— The frequency range used to calculate the A-weighted sound pressure level can include one–third–octave bands from 25 Hz to 10 000 Hz but shall always include the bands 50 – 5 000 Hz.

Any feedback or questions on this document should be directed to the user’s national standards body.

A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies the engineering method for the measurement of sound pressure level from specific service equipment in buildings as well as from unknown sources in the building or nearby. For use of this document, measurements may be performed under specified operating conditions and operating cycles according to Annex B. Measurements may also be carried out under unknown operating conditions in case the purpose is to verify conformance with requirements irrespective of the source. The operating conditions and operating cycles given in Annex B are only used if they are not opposed to national requirements and regulations.

Acoustics — Measurement of sound pressure level from service equipment or activities in buildings — Engineering method

1 Scope

This document specifies methods for measuring the sound pressure level from service equipment in a building or from other sound sources inside or outside of the building. This document specifically covers measurements of sanitary installations, mechanical ventilation, heating and cooling service equipment, lifts, rubbish chutes, boilers, blowers, pumps and other auxiliary service equipment, and motor driven car park doors; however, it can also be applied to measurements of equipment or activities in in or nearby a building. To include noise from sport facilities, pubs etcetera inside or outside the building. The measurement of noise from external sound sources generating ground-borne noise are not included in this standard.

The methods are suitable for rooms with volumes of approximately 300 m^3 or less e.g. in dwellings, hotels, schools, offices and hospitals. The standard is generally not intended for measurements in large auditoriums and concert halls, nor where the source is located at a distance from the building where sound propagation may change with weather conditions. However, the operating conditions and operating cycles in Annex B can be used in such cases.

The service equipment sound pressure level is determined as the maximum *A*-weighted and optionally *C*-weighted sound pressure level occurring during a specified operation cycle of the service equipment under test, or as the equivalent continuous sound pressure level in one–third–octave bands determined with a specified integration time. *A*-weighted and *C*-weighted values are calculated from one–third–octave–band measurements or optionally from octave–band measurements.

2 Normative references

The following documents are referred to in the text in such a way that some or all their content constitutes requirements 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.

IEC 60942, *Electroacoustics — Sound calibrators*

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

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

ISO 3382-2, *Acoustics — Measurement of the reverberation time of rooms with reference to other acoustical parameters*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Definition of quantities

4.1

average sound pressure level

$$L = 10 \lg \left[\frac{1}{n} \sum_{i=1}^{n} 10^{0,1 L_i} \right] \text{dB} \quad (1)$$

where

L_i is ten times the logarithm to the base 10 of the ratio of the time–mean–square of the sound–pressure signal, $p^2(t)$, to the square of the reference sound pressure constant p_0^2, measured at a position *i*, with a particular frequency weighting as well as a particular time weighting or time averaging, expressed in decibels

p is the sound pressure, which is the difference between an instantaneous total pressure and the corresponding static pressure in the air, expressed in pascals (N/m^2)

p_0 is the reference sound pressure 20 µPa

n is the number of microphone positions in the room where the sound pressure level is measured frequency weightings, time weightings and time averaging are selected from those defined in IEC 61672-1

Note 1 A time weighting denotes a running time average in a sound level meter that determines how quickly it reacts to variations in the sound pressure signal. The time weighting function continuously adds an exponentially decaying weight by time, with a specific time constant, to the square of the registered sound pressure signals during the calculation of the mean square value, as defined in IEC 61672-1. There are two types of time weighting in this standard used to measure maximum levels: the fast *"F"* (0,125 s) and the slow *"S"* (1 s). When a time average sound pressure signal is calculated, all registrations during a measurement interval are counted with equal weights and this average is denoted an equivalent sound pressure level.

Note 2 A frequency weighting denotes a filtering, where sound pressure signals pass through only if they fall within the limits of the specific frequency bands.

4.2

frequency bands

f

for the purpose of this standard, frequency bands denote one–third–octave–bands either in the restricted range 50–5 000 Hz, or the extended range 25–10 000 Hz, or in octave–bands 31,5–8 000 Hz, or a specific frequency range, with centre frequencies and bandwidths defined in IEC 612604.3

4.3

***A*- weighted sound pressure level calculated from frequency band values**

L_A

$$L_A = 10 \lg \left[\sum_{i=1}^{n} 10^{0,1(L_i + A_i)} \right] \text{dB} \quad (2)$$

where L_i is the sound pressure level in the frequency band *i*, and A_i is the *A*-weighting correction of this frequency band *i* (see Annex A). The value of L_i depends on the measurements, but can be any of the parameters of 4.6

4.4

***C*- weighted sound pressure level calculated from frequency band values**

L_C

$$L_C = 10 \lg [\sum_{i=1}^{n} 10^{0,1(L_i + C_i)}] \text{ dB} \quad (3)$$

where L_i is the sound pressure level in the frequency band *i*, and C_i is the *C*-weighting correction of this frequency band (see Annex A). The value of L_i depends on the measurements, but can be any of the parameters of 4.6

4.5

sound exposure level

L_E

$$L_E = 10 \lg [\frac{1}{t_0} \int_{t_1}^{t_2} \frac{p^2(t)}{p_0^2} dt] \text{ dB} \quad (4)$$

where

p is the sound pressure, which is the difference between an instantaneous total pressure and the corresponding static pressure in the air, expressed in pascals (N/m^2)

$t_2 - t_1$ is a stated time interval long enough to include all significant sounds of a stated event, in seconds

p_0 is the reference sound pressure constant 20 µPa

t_0 is the reference duration 1 s

4.6

service equipment sound pressure levels in frequency bands

in the following subclauses 4.6.1 to 4.6.9, the frequency band values, or weighted values are defined which can be measured according to this document. See also Clause 6, Table 1

4.6.1

L_{Smax}

maximum sound pressure level in frequency bands determined with time weighting "*S*"

4.6.2

$L_{Smax,nT}$

maximum sound pressure level in frequency bands determined with time weighting "*S*" and standardized to a reference reverberation time (4.8, equation (5))

4.6.3

$L_{Smax,n}$

maximum sound pressure level in frequency bands determined with time weighting "*S*" and normalized to an equivalent sound absorption area of 10 m^2 (4.8, equation (6))

4.6.4

L_{Fmax}

maximum sound pressure level in frequency bands determined with time weighting "*F*"

4.6.5

$L_{Fmax,nT}$

maximum sound pressure level in frequency bands determined with time weighting "*F*" and standardized to a reference reverberation time (4.8, equation (5))

4.6.6

$L_{Fmax,n}$

maximum sound pressure level in frequency bands determined with time weighting "*F*" and normalized to an equivalent sound absorption area of 10 m^2 (4.8, equation (6))

4.6.7

L_{eq}

equivalent continuous sound pressure level in frequency bands measured during a specified duration

Note L_{eq} denotes a time averaged sound pressure level, calculated as in equation (4), but with the reference duration t_0 (1 s) replaced by the measurement duration $t_2 - t_1$. Thus, it is related to a sound exposure level with the same duration, or vice versa, by the relation $L_{eq} = L_E - 10 \lg [\frac{t_2 - t_1}{t_0}]$. For a continuous sound pressure level that hardly varies by time, the L_{eq} value does not change much even if the duration is prolonged, but for levels that vary considerably by time the measurement duration can be indicated.

4.6.8

$L_{eq,nT}$

equivalent continuous sound pressure level in frequency bands measured during a specified duration, standardized to a reference reverberation time (4.8, equation (5))

Note The measurement duration is preferably indicated with the duration t_1 to t_2, or the required number of seconds, minutes or hours rather than by a subscript "*T*" as in IEC 61672, since this notation could be confused with the reverberation time *T* or the standardized level indicated with a subscript nT.

4.6.9

$L_{eq,n}$

equivalent continuous sound pressure level in frequency bands measured during a specified duration, normalized to an equivalent sound absorption area of 10 m^2 (4.8, equation (6))

4.7

reverberation time

T

the time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped, in frequency bands 50–5 000 Hz, expressed in seconds

4.8

standardization or normalization of the sound pressure level

the measured sound pressure levels in frequency bands can be standardized to a reference reverberation time or normalized to an equivalent sound absorption area of 10 m^2.