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

Acoustique — Mesurage du niveau de pression acoustique des équipements techniques ou activités dans les bâtiments — Méthode d'expertise

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ISO 20344, Personal protective equipment — Test methods for footwear

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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.

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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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 126, *Acoustic properties of building elements and of buildings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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

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The main changes are as follows:

- the terms and definitions have been revised;
- the procedure to detect and average spatial and temporal variations of the sound has been revised;
- measurements can be performed to verify sound levels either from a specific service equipment or an activity in the building, with operating conditions described in a normative Annex B or by national guidelines if such exist for a specific type of service equipment, e.g. lifts;
- the title is updated to reflect that also sound from activities in the building can be measured according to this document, e.g. music sound from a restaurant or sports premises in the same building;

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- measurements are performed in one-third-octave-bands;
- octave-band levels, without corrections for reverberation times or background noise may be measured or estimated from the one-third-octave-band levels and reported optionally, but they are not used to calculate the *A*-weighted and *C*-weighted sound pressure levels;
- standardization with respect to reverberation times applies to the 50 Hz to 5 000 Hz one-third-octave-bands;
- the frequency range used to calculate the *A*-weighted and *C*-weighted sound pressure levels can include one-third-octave bands from 25 Hz to 10 000 Hz but shall always include the bands 50 Hz to 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.

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Introduction

Many countries have building regulations intended to protect people from noise in their homes or workplaces. For the purpose of verification of compliance with such regulations, there is a need for a standardized method for the measurement of sound pressure levels from service equipment or activities in this building. This document specifies a procedure for such measurements, under specific operating conditions and operating cycles.

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

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1 Scope

This document specifies ~~the an~~ engineering method for the measurement of sound pressure levels in rooms from ~~specific service equipment or activities installed in buildings~~ the building.

This document covers specifically measurements of sound from sanitary installations, mechanical ventilation, heating and cooling service equipment, lifts, rubbish chutes, heating devices, blowers, pumps and other auxiliary service equipment, and motor driven car park doors. It can also be applied to measurements of sounds from other types of equipment or activities in this within the building, e.g. noise from sport facilities, ~~pubs etcetera~~. ~~The measurement of noise from external sound sources generating air-borne or ground-borne noise are not included in this document~~ restaurants.

~~The operating conditions and operating cycles given in Annex B shall be used except if there are guidelines in national requirements and regulations which shall then be applied instead of the guidelines in Annex B.~~

~~The measurement of noise from external sound sources generating air-borne or ground-borne noise in the building are not included in this document.~~

The methods are suitable for rooms with volumes of approximately 300 m³ or less ~~e.g. for instance~~, in dwellings, hotels, schools, offices and hospitals.

The ~~standard is~~ methods are not intended for measurements in large ~~auditoriums, office landscapes~~ auditoria or concert halls. ~~However, the operating conditions and operating cycles in Annex B can be used complementary to other methods 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 single number values shall be calculated from one-third octave band measurements corrected for background noise and reverberation times.~~

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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.

~~<std>IEC 60942, Electroacoustics — Sound calibrators</std>~~

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~~<std>IEC 61260, Electroacoustics — Octave-band and fractional octave-band filters</std>~~

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~~<std>IEC 61672-1, Electroacoustics — Sound level meters — Part 1: Specifications</std>~~

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~~<std>ISO 3382-2, Acoustics — Measurement of room acoustic parameters — Part 2: Reverberation time in ordinary rooms</std>~~

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

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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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology 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/>

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3.1 sound pressure level

L_i
ten times the logarithm to the base 10 of the ratio of the square of the sound pressure $p^2(t)$, to the square of the reference sound pressure p_0^2 , measured in a position i with a particular time weighting and a particular frequency weighting, selected from those defined in IEC 61672-1

Note_1_to_entry: L_i is expressed in decibels.

Note_2_to_entry: The reference sound pressure is 20 μ Pa.

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3.2 maximum sound pressure level with time weighting "S"

L_{Smax}
maximum sound pressure level measured in one-third-octave-bands determined with time weighting "S"

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3.3 maximum sound pressure level with time weighting "F"

L_{Fmax}
maximum sound pressure level measured in one-third-octave-bands determined with time weighting "F"

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3.4 equivalent continuous sound pressure level

L_{eq}
sound pressure level measured in one-third-octave-bands determined as a time average of the squared sound pressure during a stated integration time.

Note_1_to_entry: The integration time, can be indicated with additional subscripts for the stated time interval or a stated duration, e.g. L_{22-06} or L_{30s} or L_{1h} .

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3.5 average sound pressure level L

ten times the logarithm to the base 10 of the ratio of the space and time average of the square of the sound pressure $p^2(t)$, to the square of the reference sound pressure p_0^2 , the space average being taken over the entire room with the exception of those parts where the direct radiation of a sound source or the near field of the boundaries (walls, etc.) is of significant influence.

Note_1_to_entry:-L is expressed in decibels.

Note_2_to_entry:-The space average can be calculated from measurements of the sound pressure level L_i taken in n positions, including repetitions in one position, according to the Formula:

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

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

Note_3_to_entry:-The measured sound pressure levels can be maximum time weighted levels L_{Smax} or L_{Fmax} , or equivalent continuous sound pressure levels L_{eq} .

3.6 reverberation time

T
duration required for the space-averaged sound energy density in an enclosure to decrease by 60 dB after the source emission has stopped

Note_1_to_entry:-The reverberation time is expressed in seconds.

Note_2_to_entry:- T can be evaluated based on a smaller dynamic range than 60 dB and extrapolated to a decay time of 60 dB. It is then labelled accordingly. Thus, if T is derived from the time at which the decay curve first reaches 5 dB and 25 dB below the initial level, it is labelled T_{20} . If decay values of 5 dB and 35 dB below the initial level are used, it is labelled T_{30} .

Note_3_to_entry:- T is measured in one-third-octave-bands from 50 Hz to 5 000 Hz.

3.7 standardized average sound pressure level

L_{nT}
average sound pressure level standardized to a reference reverberation time in one-third-octave-bands.

Note_1_to_entry:-To calculate the standardized quantity, the following formula applies:

$$L_{nT} = L - 10 \lg \left[\frac{T}{T_0} \right] \text{dB}$$

$$L_{nT} = L - 10 \lg \left[\frac{T}{T_0} \right] \text{dB}$$

where

T_n is the measured reverberation time in seconds;

T_0 reference reverberation time 0,5 seconds.

3.8 normalized average sound pressure level

L_n
average sound pressure level normalized to an equivalent sound absorption area of 10 m² in one-third-octave-bands.

Note_1_to_entry:-To calculate the normalized quantity, the following formula applies:

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