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Acoustics — Acoustic classification of dwellings

Acoustique — Système de classification acoustique des logements

PROOF/ÉPREUVE

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Foreword

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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 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).

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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 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

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

Building regulations typically specify requirements about acoustic conditions for new dwellings. However, complying with such requirements does not guarantee satisfactory conditions for the occupants. Thus, there is a need for a guideline with acoustic classes reflecting higher levels of acoustic comfort in new housing. In addition, this document provides a useful tool for characterizing acoustic conditions in older housing and for specifying the goal for acoustic upgrading, when renovating.

The classification guideline specifies criteria for six classes A, B, C, D, E and F for dwellings, class A being the highest class and F the lowest class. If no acoustic performance is required, or the performance is outside the indicated classes or not determined, it can be declared as NPD (no performance determined).

Acoustics — Acoustic classification of dwellings

1 Scope

This document describes criteria and procedures for acoustic classification of dwellings.

The purpose of this document is to make it easier for developers to specify a classified level of acoustic quality for a dwelling, and help users and builders to be informed about the acoustic conditions and define increased acoustic quality. The document can also be applied as a general tool to characterize the quality of the existing housing stock and includes provisions for classifying the acoustic quality before and after renovation has taken place. By the acoustic quality for a dwelling is understood the quality of the acoustic performances typically included in building regulations, e.g. sound insulation towards neighbouring premises and road traffic as well as sound from service equipment. Sound insulation and room acoustics internally in a dwelling are not included in the acoustic classes defined.

This document does not have a legal status in a country, unless decided by its own authorities. However, an additional purpose of this document is to help national authorities and standardization organisations to develop or revise national building regulations and acoustic classification schemes.

For the purpose of this document, the term "dwellings" refers to detached and attached dwelling-houses, buildings with several flats as well as individual dwellings, and a dwelling is the living space for a household.

2 Normative references

The following documents are referred to in the text in such a way that some or all of 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.

ISO 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation*

ISO 717-2, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 2: Impact sound insulation*

ISO 1996-1, *Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures*

ISO 1996-2, *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels*

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

ISO 10052, *Acoustics — Field measurements of airborne and impact sound insulation and of service equipment sound — Survey method*

ISO 12354-1, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 1: Airborne sound insulation between rooms*

ISO 12354-2, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 2: Impact sound insulation between rooms*

ISO 12354-3, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound*

EN 12354-5, *Building acoustics — Estimation of acoustic performance of building from the performance of elements — Part 5: Sounds levels due to the service equipment*

EN 12354-6, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 6: Sound absorption in enclosed spaces*

ISO 16032, *Acoustics — Measurement of sound pressure level from service equipment in buildings — Engineering method*

ISO 16283-1, *Acoustics — Field measurement of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation*

ISO 16283-2, *Acoustics — Field measurement of sound insulation in buildings and of building elements — Part 2: Impact sound insulation*

ISO 16283-3, *Acoustics — Field measurement of sound insulation in buildings and of building elements — Part 3: Façade sound insulation*

3 Terms and definitions

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

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 http://www.electropedia.org/

3.1 General

3.1.1
airborne sound insulation
insulation against airborne sound measured in accordance with ISO 16283-1 and determined in frequency bands (one-third-octave bands or octave bands) from which single-number ratings for the building performance can be obtained in accordance with ISO 717-1

Note 1 to entry: Single number ratings are expressed in decibels.

Note 2 to entry: Conversion between different single number quantities, e.g. between R'_{w} and $D_{nT,w}$, is described in ISO 12354-1.

3.1.2
impact sound insulation
insulation against impact sound measured as an impact sound pressure level in accordance with ISO 16283-2 and determined in frequency bands (one-third octave bands or octave bands) from which single-number ratings for the building performance can be obtained in accordance with ISO 717-2

Note 1 to entry: Single number ratings are expressed in decibels.

Note 2 to entry: In ISO 717-2, it is referred to as impact sound pressure level.

Note 3 to entry: Conversion between different single number quantities, e.g. between $L'_{n,w}$ and $L'_{nT,w}$, is described in ISO 12354-2.

3.1.3
airborne sound insulation of building envelopes
insulation against sound from the outside measured in accordance with ISO 16283-3 and determined in frequency bands (one-third-octave bands or octave bands) from which single-number ratings for the building performance can be obtained in accordance with ISO 717-1

Note 1 to entry: Single number ratings are expressed in decibels.

Note 2 to entry: The application of spectrum adaptation terms C and C_{tr} for different types of sound source is described in ISO 717-1.

Note 3 to entry: The building envelope includes all façade components, including windows, air intakes and roofs.

3.1.4
day-evening-night sound pressure level
L_{den}
weighted sound pressure level as defined in ISO 1996-1 and determined in accordance with ISO 1996-2

$$L_{den} = 10\lg\left\{\frac{1}{24}\left[t_{day}\,10^{0,1\,L_{day}} + t_{evening}\,10^{0,1\left(L_{evening}+5\right)} + t_{night}\,10^{0,1\left(L_{night}+10\right)}\right]\right\}$$

where

L_{den}, L_{day}, $L_{evening}$ and L_{night}	are expressed in decibels (dB),
t_{day}, $t_{evening}$ and t_{night}	are expressed in hours,
L_{day}, $L_{evening}$ and L_{night}	are for the periods t_{day}, $t_{evening}$ and t_{night}, respectively, and
$t_{day} + t_{evening} + t_{night}$	= 24 h.

Note 1 to entry: The default values for t_{day}, $t_{evening}$ and t_{night} are 12 h, 4 h and 8 h, respectively, but individual countries may define these time periods differently.

3.1.5
sound pressure level from service equipment

sound pressure level in a room due to the typical operation of service equipment in a building

Note 1 to entry: It is expressed in decibels.

Note 2 to entry: The measurement result is given as a single-number quantity, A-weighted time-averaged sound pressure level and/or the A-weighted maximum sound pressure level using time-weighting Fast (F) or Slow (S) during a specified working cycle of considered equipment.

3.1.6
service equipment
permanent outdoor and indoor technical installations of a building, such as ventilation systems, lifts, heating systems, cooling systems, emergency power supplies, sanitary installations, central vacuum cleaner, heat pumps, motorized equipment like roller shutters and garage doors, mechanical door closers, internal rainwater pipes, and other similar installations necessary for operation of the building

3.1.7
reverberation time
T
time that is required for the sound pressure level to decrease by 60 dB after the sound source has stopped

Note 1 to entry: T is expressed in seconds.

Note 2 to entry: Measurements are carried out according to ISO 3382-2.

3.1.8
equivalent absorption area of a room
A
hypothetical area of a totally absorbing surface without diffraction effects which, if it were the only absorbing element in the room, would give the same *reverberation time* (3.1.7) as the room under consideration

Note 1 to entry: A is expressed in m^2.

3.1.9
walkable surface
S_{floor}
total surface that can be trodden as measured in a plan view and eventually summed over several storeys within the same space

Note 1 to entry: The surface refers to a top view.

Note 2 to entry: S_{floor} is expressed in m^2.

3.1.10
habitable room
room which provides the accommodation of the dwelling, including living room, dining room, study, home office, conservatory, bedroom, etc., excluding bathroom, WC, utility room, store room and circulation space

3.1.11
access area
any type of area which is accessible to all habitants in the building, such as stairwells, corridors, central lobby areas, passageways and other communal areas shared with other units

3.2 Classes and single-number quantities to express building performance

3.2.1
class
category specifying a defined level of acoustic conditions in dwellings

Note 1 to entry: The classes are A, B, C, D, E, F and NPD.

Note 2 to entry: The indication NPD (no performance determined) can be used for dwellings where no acoustic performance is required or determined, or if the performance does not comply with class F.

3.2.2
weighted standardized level difference
$D_{nT,w}$
difference in the space and time average sound pressure levels in two rooms produced by one or more sound sources in one of them, corresponding to a reference value of the reverberation time in the receiving room in accordance with ISO 16283-1 and weighted to a single number according to ISO 717-1

Note 1 to entry: $D_{nT,w}$ is expressed in decibels.

3.2.3
standardized A-weighted level difference
$D_{nT,A}$
sum of the *weighted standardized level difference* (3.2.2), $D_{nT,w}$, and the spectrum adaptation term, C, according to ISO 717-1 ($D_{nT,A} = D_{nT,w} + C$)

Note 1 to entry: $D_{nT,A}$ is expressed in decibels.

3.2.4
standardized A-weighted level difference extended to low frequencies
$D_{nT,50}$
sum of the *weighted standardized level difference* (3.2.2), $D_{nT,w}$, and the spectrum adaptation term, $C_{50\text{-}3150}$, according to ISO 717-1 ($D_{nT,50} = D_{nT,w} + C_{50\text{-}3150}$)

Note 1 to entry: $D_{nT,50}$ is expressed in decibels.

3.2.5
weighted standardized impact sound pressure level
$L'_{nT,w}$
space and time average sound pressure level, when the floor under test is excited by the standardized tapping machine corresponding to a reference value of the reverberation time in the receiving room in accordance with ISO 16283-2 and weighted to a single number according to ISO 717-2

Note 1 to entry: $L'_{nT,w}$ is expressed in decibels.

3.2.6
weighted standardized impact sound pressure level extended to low frequencies
$L'_{nT,50}$
sum of the *weighted standardized impact sound pressure level* (3.2.5), $L'_{nT,w}$, and the spectrum adaptation term, $C_{I,50\text{-}2500}$, according to ISO 717-2 ($L'_{nT,50} = L'_{nT,w} + C_{I,50\text{-}2500}$)

Note 1 to entry: $L'_{nT,50}$ is expressed in decibels.

3.2.7
weighted standardized level difference for a building envelope
$D_{nT,A,tr}$
sum of the *weighted standardized level difference* (3.2.2) between the sound pressure level outdoor at 2 m in front of the building envelope and the sound pressure level in the receiving room, corresponding to a reference value of the reverberation time in accordance with ISO 16283-3 and weighted to a single number according to ISO 717-1, and the spectrum adaptation term, C_{tr}, according to ISO 717-1 ($D_{nT,A,tr} = D_{2m,nT,w} + C_{tr}$)

Note 1 to entry: $D_{nT,A,tr}$ is expressed in decibels. It may also be expressed as $D_{2m,nT,A,tr}$.

3.2.8
standardized A-weighted equivalent sound pressure level
$L_{A,eq,nT}$

standardized equivalent A-weighted sound pressure level in a room, due to the sound produced by service equipment in the building, measured according to ISO 10052 or ISO 16032

Note 1 to entry: $L_{A,eq,nT}$ is expressed in decibels.

Note 2 to entry: This sound pressure level is obtained from the equivalent sound pressure level in octave bands, L_{eq}, from 63 Hz to 4 kHz. The sound pressure levels in octave bands are standardized, $L_{eq,nT}$.

Note 3 to entry: Direct reading of an A-weighted sound pressure level and simplified standardization (correction for reverberation time from a table) may be made for survey purposes according to ISO 10052, but in case of dispute, the engineering method in ISO 16032 with measured reverberation times is the reference method.

3.2.9
standardized A-weighted maximum sound pressure level with F time weighting
$L_{AF,max,nT}$
standardized and A-weighted maximum sound pressure level using time weighting "F" in a room, due to the sound produced by *service equipment* (3.1.6) in the building, measured according to ISO 10052 or ISO 16032

Note 1 to entry: $L_{AF,max,nT}$ is expressed in decibels.

Note 2 to entry: When this sound pressure level is determined according to ISO 10052, it is obtained by direct reading of an A-weighted maximum sound pressure level or from the maximum sound pressure level in octave bands from 63 Hz to 4 kHz using time weighting "F". The sound pressure levels are standardized, $L_{F,max,nT}$.