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Acoustics — Laboratory and field measurement of the flanking transmission for airborne, impact and building service equipment sound between adjoining rooms —

Part 5: **Radiation efficiencies of building elements**

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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).

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).

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 ISO/TC 43, Subcommittee SC 2, *Building Acoustics*.

A list of all parts in the ISO 10848 series can be found on the ISO website.

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 describes the measurement of the radiation efficiency of an element using structure-borne and/or acoustical excitation. Both these radiation efficiencies are required to estimate the sound reduction index due to resonant transmission only, according to ISO 12354-1:2017, Annex B.

For Type B elements as defined in ISO 10848-1:2017 and ISO 12354-1:2017, the radiation efficiency of an element using structure-borne excitation is required to calculate flanking transmission. It is also required to estimate adaptation terms used in predicting service equipment sound according to ISO 12354-5:2009.

Acoustics — Laboratory and field measurement of the flanking transmission for airborne, impact and building service equipment sound between adjoining rooms —

Part 5:
Radiation efficiencies of building elements

1 Scope

ISO 10848 (all parts) specifies laboratory and field measurement methods to characterize the flanking transmission of one or several building components.

This part of ISO 10848 specifies measurement methods to be performed in the laboratory to characterize the acoustic radiation of a building element when it is directly excited by an airborne or structure-borne source. It is applicable to single-leaf and double-leaf elements (see ISO 12354-1:2017 Annex F, F2). The measured quantity can be used as input data for prediction methods, such as ISO 12354-1 and ISO 12354-2, to compare products, or to express a requirement.

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 10140-5, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment*

ISO 10848-1:2017, *Acoustics — Laboratory and field measurement of flanking transmission for airborne, impact and building service equipment sound between adjoining rooms — Part 1: Frame document*

ISO 12999-1, *Acoustics — Determination and application of measurement uncertainties in building acoustics — Part 1: 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
average velocity level
L_v

ten times the common logarithm of the ratio of the time and space averaged mean-square normal velocity of an element to the squared reference velocity according to equation (1)

$$L_v = 10\lg\left(\frac{\frac{1}{T_m}\int_0^{T_m} v^2(t)\,dt}{v_0^2}\right) \tag{1}$$

where

v_0 is the reference velocity, in metres per second; $v_0 = 1 \times 10^{-9}$ m/s

T_m is the integration time, in seconds.

Note 1 to entry: This quantity is expressed in decibels.

Note 2 to entry: When considering sound radiation, using 5×10^{-8} m/s as a reference velocity leads to simpler equations; however, 10^{-9} m/s is the reference used in ISO 10848-1; hence this reference has also been used in this document. As a result, 34 dB has been added in equation (11), (12) and (A.3).

Note 3 to entry: If stationary airborne or structure-borne excitation is used, the spatial averaging is calculated according to equation (2)

$$L_v = 10\lg\left(\frac{v_1^2 + v_2^2 + + v_n^2}{n \cdot v_0^2}\right) \tag{2}$$

where

v_1, v_2, v_n are root mean square (rms) velocities at n different positions on the element, in metres per second.

3.2
average sound pressure level in a room
L_p

ten times the common logarithm of the ratio of the space and time average of the sound pressure squared to the square of the reference sound pressure, 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: This quantity is expressed in decibels.

Note 2 to entry: In the case of stationary airborne or structure-borne excitation and if a continuously moving microphone is used, L_p is determined according to equation (3)

$$L_p = 10\lg\left(\frac{\frac{1}{T_m}\int_0^{T_m} p^2(t)\,dt}{p_0^2}\right) \tag{3}$$

where

p is the sound pressure, in pascals;

p_0 is the reference sound pressure, in pascals; $p_0 = 20$ µPa;

T_m is the integration time, in seconds.

Note 3 to entry: In the case of stationary airborne or structure-borne excitation and if fixed microphone positions are used, L_p is determined according to equation (4)

$$L_p = 10\lg\left(\frac{p_1^2 + p_2^2 + \ldots + p_n^2}{n \cdot p_0^2}\right) \tag{4}$$

where

$p_1, p_2, \ldots p_n$ are rms sound pressures at n different positions in the room, in pascals.

In practice usually the sound pressure levels $L_{p,i}$ are measured. In this case L_p is determined according to equation (5)

$$L_p = 10\lg\left(\frac{1}{n}\sum_{i=1}^{n} 10^{L_{p,i}/10}\right) \tag{5}$$

where

$L_{p,i}$ are the sound pressure levels at position i from n different positions in the room, in decibels.

3.3
radiation function
***L*RF**

difference between the average sound pressure level in the receiving room and the average velocity level of the element on the receiving room side according to equation (6):

$$L_{RF} = L_p - L_v \tag{6}$$

Note 1 to entry: This quantity is expressed in decibels.

Note 2 to entry: In the case of stationary excitation using a single source at different positions, the radiation function shall be determined according to equation (7)

$$L_{RF} = \frac{1}{M}\sum_{m=1}^{M}(L_{RF})_m \tag{7}$$

where

M is the number of excitation positions (airborne or structure borne);

$(L_{RF})_m$ is the radiation function for excitation position m.

Note 3 to entry: If transient structure-borne excitation is used, then sound pressure level and velocity level should be measured simultaneously, each at one location and for one excitation position, and the radiation function determined according to equation (8)

$$L_{RF} = \frac{1}{MN}\sum_{m=1}^{M}\sum_{n=1}^{N}(L_{RF})_{mn} \tag{8}$$

M is the number of excitation points on the element;

N is the number of measurement positions which are the same in the room and on the element;

$(L_{RF})_{mn}$ is the point-to-point radiation function for one excitation position according to equation (9)