

**Ehitusakustika. Hoonete akustilise toimivuse
hindamine elementide akustilise toime põhjal. Osa
1: Ruumidevaheline õhuheli isolatsioon**

Building Acoustics - Estimation of acoustic
performance of buildings from the performance of
elements - Part 1: Airborne sound insulation between
rooms

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 12354-1:2005 sisaldab Euroopa standardi EN 12354-1:2000 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 12.09.2000 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 19.04.2000.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 12354-1:2005 consists of the English text of the European standard EN 12354-1:2000.

This standard is ratified with the order of Estonian Centre for Standardisation dated 12.09.2000 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 19.04.2000.

The standard is available from Estonian standardisation organisation.

ICS 91.120.20

Võtmesõnad: akustika, ehitus, heliisolatsioon, õhuheli

Standardite reprodutseerimis- ja levitamiseõigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:
Aru 10 Tallinn 10317 Eesti; www.evs.ee; Telefon: 605 5050; E-post: info@evs.ee

English version

Building acoustics

**Estimation of acoustic performance of buildings from
the performance of elements**

Part 1: Airborne sound insulation between rooms

Acoustique du bâtiment – Calcul de la performance acoustique des bâtiments à partir de la performance des éléments – Partie 1: Isolement acoustique aux bruits aériens entre des locaux

Bauakustik – Berechnung der akustischen Eigenschaften von Gebäuden aus den Bauteileigenschaften – Teil 1: Luftschalldämmung zwischen Räumen

This European Standard was approved by CEN on 1999-08-20.

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 Central Secretariat or to any CEN member.

The European Standards exist 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Contents

| | |
|--|----|
| Foreword..... | 4 |
| 1 Scope | 5 |
| 2 Normative references | 5 |
| 3 Relevant quantities | 6 |
| 3.1 Quantities to express building performance | 6 |
| 3.1.1 Apparent sound reduction index R' | 6 |
| 3.1.2 Standardized level difference D_{nT} | 6 |
| 3.1.3 Normalized level difference D_n | 7 |
| 3.1.4 Relation between quantities | 7 |
| 3.2 Quantities to express element performance | 7 |
| 3.2.1 Sound reduction index R | 7 |
| 3.2.2 Sound reduction index improvement ΔR | 7 |
| 3.2.3 Element normalized level difference $D_{n,e}$ | 8 |
| 3.2.4 Normalized level difference for indirect airborne transmission $D_{n,s}$ | 8 |
| 3.2.5 Flanking normalized level difference $D_{n,f}$ | 8 |
| 3.2.6 Vibration reduction index K_{ij} | 9 |
| 3.2.7 Other element data | 9 |
| 3.3 Other terms and quantities | 10 |
| 3.3.1 Direct transmission | 10 |
| 3.3.2 Indirect transmission | 10 |
| 3.3.3 Indirect airborne transmission | 10 |
| 3.3.4 Indirect structure-borne transmission (flanking transmission) | 10 |
| 3.3.5 Direction-averaged junction velocity level difference $\overline{D_{v,ij}}$ | 10 |
| 3.3.6 Flanking sound reduction index R_{ij} | 10 |
| 4 Calculation models | 11 |
| 4.1 General principles | 11 |
| 4.2 Detailed model for structure-borne transmission | 13 |
| 4.2.1 Input data | 13 |
| 4.2.2 Transfer of input data to in-situ values | 14 |
| 4.2.3 Determination of direct and flanking transmission in-situ | 16 |
| 4.2.4 Interpretation for several types of elements | 17 |
| 4.2.5 Limitations | 20 |
| 4.3 Detailed model for airborne transmission | 20 |
| 4.3.1 Determination from measured direct transmission for small elements | 20 |
| 4.3.2 Determination from measured total indirect transmission | 21 |
| 4.3.3 Determination from measured transmission for the separate elements of a system | 21 |
| 4.4 Simplified model for structure-borne transmission | 21 |
| 4.4.1 Calculation procedure | 21 |
| 4.4.2 Input data | 23 |
| 4.4.3 Limitations | 24 |
| 5 Accuracy | 24 |
| Annex A (normative) Symbols | 25 |
| Annex B (informative) Sound reduction index for monolithic elements | 29 |
| B.1 Sound reduction index in frequency bands | 29 |
| B.2 Weighted sound reduction index | 32 |
| Annex C (informative) Structural reverberation time | 35 |

| | |
|--|----|
| Annex D (informative) Sound reduction index improvement of additional layers | 38 |
| D.1 Sound reduction index improvement of layers | 38 |
| D.1.1 Direct transmission, ΔR | 38 |
| D.1.2 Flanking transmission..... | 38 |
| D.2 Weighted sound reduction index improvement of layers | 40 |
| Annex E (informative) Vibration reduction index for junctions..... | 42 |
| E.1 Determination methods..... | 42 |
| E.2 Empirical data | 42 |
| E.3 Limiting values..... | 43 |
| Annex F (informative) Determination of indirect transmission | 51 |
| F.1 Laboratory measurement of total indirect transmission | 51 |
| F.1.1 Indirect airborne transmission..... | 52 |
| F.1.2 Flanking transmission..... | 53 |
| F.2 Determination of indirect airborne transmission from known transmission for the separate elements of a system..... | 53 |
| F.2.1 Hall or corridor..... | 53 |
| F.2.2 Ventilation system | 54 |
| Annex G (informative) Laboratory weighted sound reduction index including field simulated flanking transmission ('Prüfstand mit bauähnlicher Flankenübertragung', DIN 52210) | 55 |
| Annex H (informative) Calculation examples | 57 |
| H.1 Situation..... | 57 |
| H.2 Detailed model | 58 |
| H.2.1 Results | 58 |
| H.2.2 Detailed steps for separating element, floor and inner wall | 58 |
| H.2.3 Structural reverberation time partition wall at 500 Hz octave : | 60 |
| H.3 Simplified model | 61 |
| Bibliography | 63 |

Preview generated by EVS

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 126 "Acoustic properties of building products and of buildings", the secretariat of which is held by AFNOR.

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 October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.

It is the first version of a series of standards, specifying calculation models in Building Acoustics. Although the standard covers the main types of building construction it cannot as yet cover all variations in the construction of buildings. It sets out an approach for gaining experience for future improvements and developments.

During the preparation of this standard it became clear that some of the element data necessary based on standardized measurement methods are not yet available, hence some informative annexes have been added to explain what is needed, to indicate possible measurement methods and to illustrate this with some indicative acoustical data. These annexes should form the basis for new or revised standards for building elements, which would replace these annexes.

The accuracy of this standard can only be specified in detail after widespread comparisons with field data, which can only be gathered over a period of time after establishing the prediction model. To help the user in the mean time, indications of the accuracy have been given, based on earlier comparisons with comparable prediction models. It is the responsibility of the user (i.e. a person, an organisation, the authorities) to address the consequences of the accuracy, inherent for all measurement and prediction methods, by specifying requirements for the input data and/or applying a safety margin to the results or applying some other correction.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This document describes calculation models designed to estimate the airborne sound insulation between rooms in buildings, primarily using measured data which characterize direct or indirect flanking transmission by the participating building elements and theoretically derived methods of sound propagation in structural elements.

A detailed model is described for calculation in frequency bands ; the single number rating can be determined from the calculation results. A simplified model with a restricted field of application is deduced from this, calculating directly the single number rating, using the single number ratings of the elements.

This document describes the principles of the calculation scheme, lists the relevant quantities and defines its applications and restrictions. It is intended for acoustical experts and provides the framework for the development of application documents and tools for other users in the field of building construction, taking into account local circumstances.

The calculation models described use the most general approach for engineering purposes, with a clear link to measurable quantities that specify the performance of building elements. The known limitations of these calculation models are described in this document. Users should, however, be aware that other calculation models also exist, each with their own applicability and restrictions.

The models are based on experience with predictions for dwellings ; they could also be used for other types of buildings provided the construction systems and dimensions of elements are not too different from those in dwellings.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 20140-10, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 10 : Laboratory measurement of airborne sound insulation of small building elements (ISO 140-10:1991).*

EN ISO 140-1, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 1 : Requirements for laboratory test facilities with suppressed flanking transmission (ISO 140-1:1997).*

EN ISO 140-3, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 3 : Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995).*

EN ISO 140-4, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 4 : Field measurements of airborne sound insulation between rooms (ISO 140-4:1998).*

EN ISO 717-1, *Acoustics - Rating of sound insulation in buildings and of building elements - Part 1 : Airborne sound insulation (ISO 717-1:1996).*

prEN ISO 10848-1, *Acoustics - Laboratory measurement of the flanking transmission of airborne and impact noise between adjoining rooms - Part 1 : Frame document (ISO/DIS 10848-1:1998).*