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

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NATIONAL FOREWORD

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

Acoustique du bâtiment - Calcul des performances acoustiques des bâtiments à partir des performances des éléments - Partie 5 : Niveaux sonores dûs aux équipements de bâtiment

Bauakustik - Berechnung der akustischen Eigenschaften von Gebäuden aus den Bauteileigenschaften - Teil 5: Installationsgeräusche

This European Standard was approved by CEN on 5 March 2009.

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Foreword

This document (EN 12354-5:2009) has been prepared by Technical Committee CEN/TC 126 “Acoustic properties of building elements 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of an identical text or by endorsement, at the latest by October 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document is the first version of a standard, which forms a part of a series of standards specifying calculation models in building acoustics:

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

— *Part 2: Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 2: Impact sound insulation between rooms.*

— *Part 3: Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound.*

— *Part 4: Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 4: Transmission of indoor sound to the outside.*

— *Part 5: Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 5: Sound levels due to the service equipment.*

— *Part 6: Building Acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 6: Sound absorption in enclosed spaces.*

Although this part covers the most common types of service equipment and installations in buildings, it cannot as yet cover all types and all situations. It sets out an approach for gaining experience for future improvements and developments.

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.

Annex A forms an integral part of this part of EN 12354. Annexes B, C, D, E, F, G and H are for information only.

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

Introduction

The estimation of sound levels due to service equipment in buildings is a complex task and structure-borne sources and transmission are not completely understood. In addition there are large variations between different equipment and installations and an installation often results in both airborne and structure-borne sources. This document contains a framework within which this subject can be treated. The main part (Clause 4) describes general models for sound transmission and related sources for ducts, airborne sound through buildings and structure-borne sound through buildings. For airborne and structure-borne sound transmission, parts 1 and 2 of EN 12354 are used wherever possible.

In Clause 5 the application of these models to the different types of service equipment in buildings is addressed, specifying what is already known and available and what is not. Informative annexes give additional information on various aspects, related to sources and their sound production as well as to specific aspects of sound transmission through buildings. Wherever possible references are made to available handbooks, literature or ongoing standardization work. Over the course of time some annexes or parts of them, especially those relating to the sound production by sources, can be deleted when appropriate standards become available.

For sound transmission through ducts there are standardized methods available to determine the sound power level of sources or the transmission loss of elements. Various handbooks are widely used for these estimations.

For airborne sound transmission through buildings information exists about sources and transmission, but some aspects that are particularly relevant to service equipment are less well known, such as the effect of acoustic near-fields, non-diffuse spaces and excitation and transmission at low frequencies. For these aspects some indications are given as to how they could be treated and also as an indicator for the direction of further research and future improvements to the models.

For structure-borne sound transmission similar solutions and problems exist as used for airborne sound. However, here the appropriate methods to characterize the sources for structure-borne sound excitation are just starting to become available, largely due to standardization work started within CEN (TC126/WG7) Therefore in this document a choice has been made to use a general quantity in the models, called "the characteristic structure-borne sound power level" of sources, even though there is no practical measurement method available at the moment. This allows the estimation models to have a general form that could be developed and refined in the future. For some types of equipment indications are given in an informative annex as to how this quantity can be deduced or estimated from available and current measurement methods, such as the ones already developed within CEN.

The aim of this document is to provide a general basis for a practical approach to the estimation of sound levels due to service equipment. It also clarifies the need for work on source characterisation with an indication of areas where further research work is needed.

1 Scope

This document describes calculation models to estimate the sound pressure level in buildings due to service equipment. As for the field measurement document (EN ISO 16032) it covers 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, but can also be applied to others equipment attached to or installed in buildings. The estimation is primarily based on measured data that characterises both the sources and the building constructions. The models given are applicable to calculations in frequency bands.

This document describes the principles of the calculation models, 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 link to measurable quantities that specify the performance of building elements and equipment. 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 and offices; they could also be used for other types of buildings provided the constructional dimensions are similar to those in dwellings.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 12354-1:2000, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 1: Airborne sound insulation between rooms*

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

EN 13141-1, *Ventilation for buildings — Performance testing of components/products for residential ventilation — Part 1: Externally and internally mounted air transfer devices*

EN 13141-2, *Ventilation for buildings — Performance testing of components/products for residential ventilation — Part 2: Exhaust and supply air terminal devices*

EN ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards (ISO 3740:2000)*

EN ISO 3741, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms (ISO 3741:1999)*

EN ISO 3743 (all parts), *Acoustics — Determination of sound power levels of noise sources — Engineering methods for small, movable sources in reverberant fields (ISO 3743-1:1995 and ISO 3743-2:1996)*

EN ISO 3744, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN ISO 3745, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for anechoic and semi-anechoic rooms (ISO 3745:2003)*

EN ISO 3746*, Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

EN ISO 3747*, Acoustics — Determination of sound power levels of noise sources using sound pressure — Comparison method for use in situ (ISO 3747:2000)*

EN ISO 3822-1, *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 1: Method of measurement (ISO 3822-1:1999)*

EN ISO 3822-2, *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 2: Mounting and operating conditions for draw-off taps and mixing valves (ISO 3822-2:1995)*

EN ISO 3822-3, *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 3: Mounting and operating conditions for in-line valves and appliances*

EN ISO 3822-4, *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 4: Mounting and operating conditions for special appliances*

EN ISO 7235, *Acoustics — Laboratory measurement procedure for ducted silencers and air-terminal units — Insertion loss, flow noise and total pressure loss (ISO 7235:2003)*

EN ISO 10846-1, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 1: Principles and guidelines (ISO 10846-1:2008)*

EN ISO 10846-2, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 2: Direct method for determination of the dynamic stiffness of resilient supports for translatory motion (ISO 10846-2:2008)*

EN ISO 10846-3, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 3: Indirect method for determination of the dynamic stiffness of resilient supports for translatory motion (ISO 10846-3:2002)*

EN ISO 10846-4, *Acoustics and vibration — Laboratory measurement of vibro-acoustic transfer properties of resilient elements — Part 4: Dynamic stiffness of elements other than resilient supports for translatory motion (ISO 10846-4:2003)*

EN ISO 11691, *Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method (ISO 11691:1995)*