SLOVENSKI STANDARD
oSIST prEN ISO 12999-1:2019

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Akustika - Ugotavljanje in uporaba merilne negotovosti v gradbeni akustiki - 1. del: Zvočna izolirnost (ISO/DIS 12999-1:2019)

Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 1: Sound insulation (ISO/DIS 12999-1:2019)

Akustik - Bestimmung und Anwendung der Messunsicherheiten in der Bauakustik - Teil 1: Schalldämmung (ISO/DIS 12999-1:2019)

Acoustique - Détermination et application des incertitudes de mesure dans l'acoustique des bâtiments - Partie 1: Isolation acoustique (ISO/DIS 12999-1:2019)

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Acoustics — Determination and application of measurement uncertainties in building acoustics —

Part 1:
Sound insulation

Acoustique — Détermination et application des incertitudes de mesure dans l'acoustique des bâtiments — Partie 1: Isolation acoustique

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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.

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

This second edition of ISO 12999-1 cancels and replaces the first edition (ISO 12999-1:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— The quantity σ_{R95} was removed from Table 2;

— the text in Clause 7 referring to this quantity was removed and the wording adopted;

— a new Annex D was drafted with a new table containing σR95 and an explanatory text what it is;

— new references were added.

A list of all parts in the ISO 12999 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

An assessment of uncertainties that is comprehensible and close to reality is indispensable for many questions in building acoustics. Whether a requirement is met, a laboratory delivers correct results or the acoustic properties of a product are better than the same properties of some other product can be decided only by adequately assessing the uncertainties associated with the quantities under consideration.

Uncertainties should preferably be determined following the principles of ISO/IEC Guide 98-3. This Guide specifies a detailed procedure for the uncertainty evaluation that is based upon a complete mathematical model of the measurement procedure. At the current knowledge, it seems to be impossible to formulate these models for the different quantities in building acoustics. Therefore, only the principles of such an uncertainty assessment are explained.

To come to uncertainties all the same, the concept of reproducibility and repeatability is incorporated which is the traditional way of uncertainty determination in building acoustics. This concept offers the possibility to state the uncertainty of a method and of measurements carried out according to the method, based on the results of inter-laboratory measurements.

Acoustics — Determination and application of measurement uncertainties in building acoustics —

Part 1: Sound insulation

1 Scope

This part of ISO 12999 specifies procedures for assessing the measurement uncertainty of sound insulation in building acoustics. It provides for

— a detailed uncertainty assessment;

— a determination of uncertainties by inter-laboratory tests;

— an application of uncertainties.

Furthermore, typical uncertainties are given for quantities determined according to ISO 10140, ISO 16283 and ISO 717 (all parts).

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 (all parts), *Acoustics — Rating of sound insulation in buildings and of building elements*

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 10140 (all parts), *Acoustics — Laboratory measurement of sound insulation of building elements*

ISO 16283 (all parts), *Acoustics — Field measurement of sound insulation in buildings and of building elements*

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 http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

Note 1 to entry Whenever applicable, they are equivalent to those given in ISO 5725-1, in the ISO/IEC Guide 98-3[1] and in ISO/IEC Guide 99[2].

3.1
measurand
particular quantity subject to measurement, e.g. the airborne sound insulation of a particular window pane determined in accordance with ISO 10140

3.2
measurement result
value attributed to a measurand, obtained by following the complete set of instructions given in a measurement procedure

Note 1 to entry: The measurement result may be a frequency band level or a single number value determined according to the rating procedures of ISO 717 (all parts).

3.3
uncertainty
parameter, associated with the result of a measurement, that characterizes the dispersion of the values that can reasonably be attributed to the measurand

3.4
standard uncertainty
u
uncertainty of the result of a measurement expressed as a standard deviation

3.5
combined standard uncertainty
u_c
standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or covariances of these other quantities weighted according to how the measurement result varies with changes in these quantities

3.6
expanded uncertainty
U
quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that can reasonably be attributed to the measurand

3.7
coverage factor
k
numerical factor used as a multiplier of the combined standard uncertainty in order to obtain an expanded uncertainty

3.8
repeatability condition
condition of measurement that includes the same measurement procedure, same operators, same measuring system, same location (laboratory or usual building), and replicate measurements on the same object over a short period of time

3.9
repeatability standard deviation
σ_r
standard deviation of measurement results obtained under repeatability conditions

3.10
reproducibility condition
condition of measurement that includes different locations (laboratories or usual buildings), operators, measuring systems, and replicate measurements on the same or similar objects

3.11
reproducibility standard deviation
σ_R
standard deviation of measurement results obtained under reproducibility conditions

3.12
***in-situ* condition**
condition of measurement that includes the same location (laboratory or usual building), and replicate measurements on the same object by different operators using different measuring systems

3.13
***in-situ* standard deviation**
σ_{situ}
standard deviation of measurement results obtained under *in-situ* conditions

4 Detailed uncertainty budget

The derivation of a detailed uncertainty budget is desirable to find out which uncertainty contributions are the most important ones and how these contributions can be reduced. Furthermore, such a budget reflects the individual sound fields during the measurement. Consequently, the uncertainty is valid for an individual measurement result and not for a whole family of results. Annex C gives provisions on the derivation of such uncertainty budgets.

5 Uncertainty determination by inter-laboratory measurements

5.1 General

Standard deviations determined by inter-laboratory measurements may serve as an estimate for the standard uncertainty. The general concept and the procedure for determining these standard deviations are given in ISO 5725-1 and ISO 5725-2, respectively. As many operators and laboratories as possible should participate in such inter-laboratory measurements in order to obtain reliable results.

5.2 Measurement situations

In building acoustics, three different measurement situations are to be distinguished.

a) Situation A is that a building element is characterized by laboratory measurements. In this case, the measurand is defined by the relevant part of ISO 10140, including all additional requirements e.g. for the measurement equipment and especially for the test facilities. Therefore, all measurement results that are obtained in another test facility or building also comply with this definition. The standard uncertainty, thus, is the standard deviation of reproducibility as determined by inter-laboratory measurements.

b) Situation B is described by the case that different measurement teams come to the same location to carry out measurements. The location may be a usual building or a test facility. The measurand, thus, is a property of one particular element in one particular test facility or the property of a building. The main difference to situation A is that many aspects of the airborne and structure-borne sound fields involved remain constant since the physical construction is unchanged. The standard uncertainty obtained for this situation is called *in situ* standard deviation.

c) Situation C applies to the case when the measurement is simply repeated in the same location by the same operator using the same equipment. The location may be a usual building or a test facility. The standard uncertainty is the standard deviation of repeatability as determined by inter-laboratory measurements.