SLOVENSKI STANDARD
SIST EN ISO 3382:2001

01-september-2001

Akustika - Merjenje odmevnega časa prostorov z upoštevanjem drugih akustičnih parametrov (ISO 3382:1997)

Acoustics - Measurements of the reverberation time of rooms with reference to other acoustical parameters (ISO 3382:1997)

Akustik - Messung der Nachhallzeit von Räumen mit Hinweis auf andere akustische Parameter (ISO 3382:1997)

Acoustique - Mesurage de la durée de réverbération des salles en référence a d'autres parametres acoustiques (ISO 3382:1997)

Ta slovenski standard je istoveten z: **EN ISO 3382:2000**

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17.140.01	Akustična merjenja in blaženje hrupa na splošno	Acoustic measurements and noise abatement in general
91.120.20	Akustika v stavbah. Zvočna izolacija	Acoustics in building. Sound insulation

SIST EN ISO 3382:2001 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 3382

February 2000

ICS 91.120.20

English version

Acoustics - Measurement of the reverberation time of rooms with reference to other acoustical parameters (ISO 3382:1997)

Acoustique - Mesurage de la durée de réverbération des salles en référence à d'autres paramètres acoustiques (ISO 3382:1997)

Akustik - Messung der Nachhallzeit von Räumen mit Hinweis auf andere akustische Parameter (ISO 3382:1997)

This European Standard was approved by CEN on 10 December 1999.

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.

This European Standard exists 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

Ref. No. EN ISO 3382:2000 E

Foreword

The text of the International Standard from Technical Committee ISO/TC 43 "Acoustics" of the International Organization for Standardization (ISO) has been taken over as an European Standard 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 August 2000, and conflicting national standards shall be withdrawn at the latest by August 2000.

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.

Endorsement notice

The text of the International Standard ISO 3382:1997 has been approved by CEN as a European Standard without any modification.

NOTE: Normative references to International Standards are listed in annex ZA (normative).

Annex ZA (normative)
Normative references to international publications with their relevant European publications

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.

Publication	Year	Title	EN	Year
ISO 3471	1988	Acoustics - Determination of sound power levels of noise sources - Precision methods for broad-band sources in reverberation rooms	EN 23741	1991

INTERNATIONAL STANDARD

ISO 3382

Second edition
1997-06-15

Acoustics — Measurement of the reverberation time of rooms with reference to other acoustical parameters

Acoustique — Mesurage de la durée de réverbération des salles en référence à d'autres paramètres acoustiques

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Contents

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3382 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

This second edition cancels and replaces the first edition (ISO 3382:1975), which has been technically revised.

Annexes A, B and C of this International Standard are for information only.

Introduction

The reverberation time of a room used to be regarded as the predominant indicator of its acoustical properties. Whilst reverberation time continues to be regarded as a significant parameter, there is reasonable agreement that other types of measurements such as relative sound pressure levels, early/late energy ratios, lateral energy fractions, interaural cross correlation functions and background noise levels are needed for a more complete evaluation of acoustical quality of rooms. This International Standard continues to specify room acoustic quality by reverberation time alone, but introduces two other levels of complexity in room acoustics measurement.

Annex A presents measures based on squared impulse responses: a further measure of reverberation (early decay time) and measures of relative sound levels, early/late energy fractions and lateral energy fractions in auditoria. Within these categories there is still work to be done in determining which measures are the most suitable to standardize on but, since they are all derivable from impulse responses, it is appropriate to introduce the impulse response as the basis for standard measurements. Annex B introduces binaural measurements and the head and torso simulators (dummy heads) required to make the measurements in auditoria.

Reverberation time measurements are important in the field of noise control in rooms as well as for the assessment of rooms for speech and music; this International Standard also applies to measurements in these enclosures. However, it does not apply to laboratory measurements in test facilities or reverberation rooms. Laboratory measurements require other specifications of averaging single measurements at prescribed source and microphone positions. This International Standard establishes a method for obtaining reverberation times from impulse responses and from interrupted noise. In the annexes, the concepts and details of measurement procedures for some of the newer measures are introduced, but these annexes do not constitute a part of the formal specifications of this standard. The intention is to make it possible to compare reverberation time measurements with higher certainty, and to promote the use of and consensus in measurement of the newer measures.

Acoustics — Measurement of the reverberation time of rooms with reference to other acoustical parameters

1 Scope

This International Standard specifies methods for the measurement of reverberation time in rooms. It is not restricted to auditoria or concert halls; it is also applicable to rooms intended for speech and music or where noise protection is a consideration. It describes the measurement procedure, the apparatus needed, the coverage required, and the method of evaluating the data and presenting the test report. Furthermore, it is intended for application of modern digital measuring techniques and for evaluation of room acoustical parameters derived from impulse responses.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3741:1988, *Acoustics — Determination of sound power levels of noise sources — Precision methods for broad-band sources in reverberation room.*

ISO 5725-2:1994, *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.*

IEC 268-1:1985, *Sound system equipment – Part 1: General.*

IEC 651:1979, *Sound level meters.*

IEC 1260:1995, *Electroacoustics — Octave-band filters and fractional-octave-band filters.*

ITU Recommendation P.58:1994, *Head and torso simulator for telephonometry.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 decay curve:
Decay of sound pressure level as a function of time at one point of the room after the source of sound has ceased.

NOTE 1 This decay may be either measured after the actual cut-off of a continuous sound source in the room or derived from the reverse-time integrated squared impulse response of the room.

NOTE 2 The decay directly obtained after non-continuous excitation of a room (e.g. by recording a gunshot with a level recorder) is not recommended for accurate evaluation of the reverberation time. This method should only be used for survey purposes.

3.2 interrupted noise method:
Method of obtaining decay curves by direct recording of the decay of sound pressure level after exciting a room with broadband or band limited noise.

3.3 integrated impulse response method:
Method of obtaining decay curves by reverse-time integration of the squared impulse responses.

3.4 impulse response:
Plot as a function of time of the sound pressure received in a room as a result of excitation of the room by a Dirac delta function.

NOTE 3 It is impossible in practice to create and radiate true Dirac delta functions but short transient sounds (e.g. from gunshots) may offer close enough approximations for practical measurement. An alternative measurement technique, however, is to use a period of maximum-length sequence type signal (or other deterministic, flat-spectrum signal) and transform the measured response back to an impulse response.

3.5 reverberation time, T:
Time, expressed in seconds, that would be required for the sound pressure level to decrease by 60 dB, at a rate of decay given by the linear least-squares regression of the measured decay curve from a level 5 dB below the initial level to 35 dB below.

NOTE 4 Where a decay curve is not monotonic the range to be evaluated is defined by the times at which the decay curve first reaches 5 dB and 35 dB below the initial level respectively. A value for T based on the decay rate over a smaller dynamic range (down to a minimum of 20 dB extending from 5 dB down to 25 dB down) is also allowable provided the results are appropriately labelled. In the case of ambiguity the measure for T using the decay between 5 dB and 35 dB should be called T_{30}. Using 5 dB and 25 dB, the result should be labelled T_{20} and similarly for other evaluation ranges.

3.6 States of occupancy

NOTE 5 Reverberation time measured in a room will be influenced by the number of people present and the following states of occupancy are defined for measurement purposes.

NOTE 6 An accurate description of the state of occupancy of the room is of decisive importance in assessing the results obtained by measuring the reverberation time.

NOTE 7 In theatres, a distinction shall be made between "safety curtain up" and "safety curtain down", between "orchestra pit open" and "orchestra pit closed", and also between "orchestra seated on the stage" with and without concert enclosure. In all these cases, measurement may be useful. If the safety curtain is up, the amount of furnishing of the stage is of importance and shall be described.

3.6.1 unoccupied state:
State of the room prepared for use and ready for speakers or performers and audience, but without these persons present; for concert halls and opera houses the presence of chairs for performers, music stands and percussion instruments etc. shall be taken into account.

3.6.2 studio state (only for rooms for speech and music):
State of the room occupied by the performers or speakers only (without audience), for example at rehearsals or during sound recordings; the number of performers and other persons, such as technicians, corresponding to the usual number.

3.6.3 occupied state:
State of an auditorium or theatre when 80 % to 100 % of the seats are occupied

NOTE 8 Extraordinary occupancies (such as that which would be created in a concert hall by a larger than usual orchestra or the additional presence of a choir or standees) should be noted with the results.

4 Measurement conditions

4.1 General

The measurements of reverberation time may be made with the room in any or all states of occupancy. Where the room has adjustable components for providing variable acoustical conditions, it may be relevant to carry out separate measurements with these components in each of their normal settings. The temperature and relative humidity of the air in the room should be measured to an accuracy of ± 1 °C and ± 5 % respectively.