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**Akustika - Merjenje parametrov prostorske akustike - 3. del: Velike odprte pisarne  
(ISO/DIS 3382-3:2021)**

Acoustics - Measurement of room acoustic parameters - Part 3: Open plan offices  
(ISO/DIS 3382-3:2021)

Akustik - Messung von Parametern der Raumakustik - Teil 3: Großraumbüros (ISO/DIS  
3382-3:2021)

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Acoustique - Mesurage des paramètres acoustiques des salles - Partie 3: Bureaux  
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## Acoustics — Measurement of room acoustic parameters —

### Part 3: Open plan offices

*Acoustique — Mesurage des paramètres acoustiques des salles —*  
*Partie 3: Bureaux ouverts*

ICS: 91.120.20

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# Contents

Page

Foreword.....	iv
Introduction.....	v
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Measurement conditions.....</b>	<b>3</b>
4.1 Equipment.....	3
4.2 Measurement procedure.....	3
4.2.1 Measurement conditions.....	3
4.2.2 Room acoustic zones.....	3
4.2.3 Source and microphone positions.....	4
4.2.4 Measurement quantities.....	5
<b>5 Determination of single-number quantities.....</b>	<b>6</b>
5.1 Spectrum of normal speech.....	6
5.2 Spatial decay rate of speech.....	6
5.2.1 Conventional method.....	6
5.2.2 Impulse response method.....	8
5.3 Speech level at 4 m distance.....	8
5.4 Background noise.....	9
5.5 Speech Transmission Index.....	9
5.6 Comfort and distraction distances.....	10
5.7 Typical values of single-number quantities.....	11
<b>6 Precision.....</b>	<b>11</b>
<b>7 Test report.....</b>	<b>11</b>
<b>Annex A (informative) Psychological reasoning of distraction distance.....</b>	<b>13</b>
<b>Annex B (informative) Alternative methods for determining the spatial decay rate.....</b>	<b>14</b>
<b>Annex C (informative) Examples of typical values of the single-number quantities.....</b>	<b>16</b>
<b>Annex D (informative) Accuracy.....</b>	<b>17</b>
<b>Bibliography.....</b>	<b>18</b>

## ISO/DIS 3382-3:2021(E)

### 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](http://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](http://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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee [for Project Committee] ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

This second edition cancels and replaces the first edition (ISO 3382-3:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

- new single-number quantity, comfort distance, added, and privacy distance removed;
- use of omnidirectional sound source emphasized;
- measurement conditions ([Clause 4](#)) have been clarified;
- determination of single-number quantities ([Clause 5](#)) clarified;
- use of impulse response method better described and a new Annex added;
- new [Clause 6](#) Precision and a new informative Annex Accuracy added;
- STI is determined in conformance of IEC 20268-16 using weighting factors  $\alpha$  and  $\beta$  for male gender;

A list of all parts in the ISO 3382 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](http://www.iso.org/members.html).

## Introduction

Noise and lack of speech privacy are among the most dissatisfactory environmental factors in open-plan offices [1]. Colleagues' speech is the main source of office noise. Inadequate room acoustic design of the office is one reason to the perception of noise and lack of speech privacy. Distraction due to colleagues' speech weakens the ability to concentrate and reduces productivity, especially in tasks requiring cognitive resources. Insufficient speech privacy prevents confidential conversations. Several experimental studies suggest that distraction can be reduced by reducing speech intelligibility [2,3]. A large field survey supports that reduced speech intelligibility is associated with reduced noise disturbance [4].

This part of ISO 3382 specifies a measurement method, which results in a group of single-number quantities indicating the room acoustic performance of an open-plan office in a condition when one person is speaking. They focus on spatial decay of speech while quantities in part 2 of this standard focus on temporal decay of sound.

The concept "open-plan offices" covers large office spaces where large number of occupants can work in well-defined workstations. A large share of flexible offices and activity-based offices belong to the open-plan office concept of this standard. Open-plan offices can also be found in libraries, hospital wards, industrial workplaces, and schools. According to [4], many of the single-number quantities provided by this standard are associated with the perceived noise disturbance in open-plan offices.

Room acoustic quality can be affected by the amount and positioning of absorption materials, room geometry, workstations, screens, other furniture, and background noise level, i.e. sound masking. Current literature gives good advice how the room acoustics should be designed to reach good room acoustic quality as it is defined in this standard [5,6,7].

The method describes the acoustic performance of the open-plan office in a standardized condition where a single occupant is speaking with normal speech effort. The background noise caused by building appliances or electronic masking sound is considered. The measurements are conducted in an unoccupied open-plan office because the method concerns the permanent building properties and stable room acoustic conditions as well as parts 1 and 2 of this standard. The actual noise conditions during use of the space do not belong to the scope of this standard. Although the activity noise caused by occupants can be significantly larger than the background noise from building appliances or sound masking, activity noise is beyond the scope of this standard. Presentation of acoustic design guidelines is also beyond the scope of this part of ISO 3382-3.

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# Acoustics — Measurement of room acoustic parameters —

## Part 3: Open plan offices

### 1 Scope

This document specifies methods for the measurement of room acoustic parameters in unoccupied open-plan offices. It specifies measurement procedures, the apparatus needed, the coverage required, the method for evaluating the data, and the presentation of the test report.

### 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 3382-1, *Acoustics — Measurement of room acoustic parameters — Part 1: Performance spaces*

ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards*

IEC 60268-16:2011, *Sound system equipment — Part 16: Objective rating of speech intelligibility by speech transmission index*

IEC 60942, *Electroacoustics — Sound calibrators*

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

### 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

#### **Omnidirectional sound source**

#### **OSS**

a sound source which radiates sound evenly to all directions.

#### 3.2

#### **spatial distribution of the A-weighted SPL of speech**

curve which shows how the A-weighted sound pressure level (SPL) decreases as a function of the distance from the middle point of the OSS emitting noise with the sound power level of normal speech within 125 Hz to 8 000 Hz.

## ISO/DIS 3382-3:2021(E)

### 3.3

#### spatial decay rate of speech

$D_{2,S}$

rate of spatial decay of A-weighted SPL of speech per distance doubling in decibels

Note 1 to entry: The quantity describes how fast the A-weighted SPL of speech attenuates in the open-plan office. Large value means strong overall room acoustic attenuation. In free field,  $D_{2,S} = 6$  dB.

### 3.4

#### Speech level at 4 m distance

$L_{p,A,S,4m}$

nominal A-weighted SPL in decibels at the distance of 4,0 m from the middle point of the OSS emitting noise with the sound power level of normal speech within 125 Hz to 8 000 Hz

Note 1 to entry: The quantity describes the A-weighted SPL of speech at a distance within which the nearest workstation is nearly always located. Small value means strong room acoustic attenuation near the OSS.

### 3.5

#### comfort distance

$r_C$

distance from the speaker in meters where the A-weighted SPL of speech falls below 45 dB when the OSS is emitting noise with the sound power level of normal speech within 125 Hz to 8 000 Hz

Note 1 to entry: Comfort distance reduces with increasing  $D_{2,S}$  and decreasing  $L_{p,A,S,4m}$ .

### 3.6

#### background noise level

$L_{p,B}$

unweighted mean SPL of background noise in decibels present at the workstations along the measurement path during working hours when occupants are absent

Note 1 to entry: Background noise is measured in octave bands within 125 Hz to 8 000 Hz.

### 3.7

#### speech transmission index

STI

a proportional number representing the transmission quality of speech. STI has a value between 0.00 and 1.00.

[SOURCE: IEC 60268-16:2011]

Note 1 to entry: The value of STI is associated with subjective speech intelligibility.

### 3.8

#### spatial distribution of the speech transmission index

curve which shows how the STI decreases as a function of the distance from the OSS.

### 3.9

#### distraction distance

$r_D$

distance from the OSS in meters where the STI falls below 0,50.

Note 1 to entry: Distraction distance reduces with decreasing  $r_C$  and increasing  $L_{p,B}$ . Small value indicates high speech privacy. When the speaker is located beyond the distraction distance from the occupant, occupant's work performance is expected to be better than at shorter distances (see [Annex A](#)).

### 3.10

#### Workstation

Workstation is a furniture ensemble containing one ergonomically adjustable chair and a working table having a minimum floor area of 70x70 cm. The height of tabletop can be adjusted to a height of 75 cm from the floor. Workstation can contain also other components, such as screen(s), storage unit(s), display units, or luminaire.

## 4 Measurement conditions

### 4.1 Equipment

**4.1.1 Sound source.** Omnidirectional sound source (abbreviated by OSS) shall be used in all measurements. This source type is used since occupants in an open-plan office do not speak in an exactly fixed direction. The requirements given in ISO 3382-1 for the OSS within 125 – 4000 Hz shall be fulfilled for measurements to be in accordance with this part of ISO 3382.

NOTE There are no requirements for the 8 000 Hz octave band.

**4.1.2 Microphone.** SPLs in each octave band and at each microphone position shall be measured using a sound level meter meeting the requirements of IEC 61672-1, class 1. The microphone shall be omnidirectional considering any supplementary equipment connected to it.

**4.1.3 Analyzer.** The octave-band filters of the analyzer or analyzer software shall comply with IEC 61260. If the signal is recorded, e.g., by using analogue or digital recorders for off-line processing, it shall be ensured that the whole instrumentation complies with the above-mentioned requirements.

**4.1.4 Calibrator.** Before and after each measurement series, the acoustical sensitivity of the measurement system shall be checked using a sound calibrator that complies with IEC 60942. The results of the calibration checks shall be documented. A difference of more than 0,5 dB between calibration checks shall be a cause to repeat measurements. It is recommended that the calibration be checked whenever batteries or open-plan office are changed.

### 4.2 Measurement procedure

#### 4.2.1 Measurement conditions

Measurements can be conducted in open-plan offices of any kind and with any configuration of ceiling absorbers, wall absorbers, sound masking systems, floor coverings, fixed partitions, workstations, screens, storage units, and other furniture, whether they are fixed or mobile. The results are valid only to the specified configuration which prevails during the measurement. Therefore, it is important to carefully report these factors along with the measurement results.

Background noise means all stationary sounds, which are present during normal working hours and are not caused by the occupants. Such sounds are e.g. heating, ventilation, and air conditioning (HVAC) devices, environmental noise caused by sources outside the building, or an electronic sound-masking system.

The HVAC devices shall operate on the same power as during typical working hours. If the office is equipped with a sound-masking system, it shall be switched on during the measurement. Sound masking shall operate at the same level and with the same spectrum as during typical working hours. Adaptive masking systems should be tested separately for minimum and maximum levels. Appliances such as refrigerators, printers, coffee machines, radios, and video projectors shall be shut down if they increase the background noise in any measurement position. Windows and balcony doors shall be closed. All measurements shall be conducted when the occupants are absent. Only the measurement technician can be present in the open-plan office.

If the table heights are electrically adjustable, the tabletop height is set to  $75\pm 5$  cm from the floor in the workstations located along the measurement path.

#### 4.2.2 Room acoustic zones

If the open-plan offices can contain two or more zones where the absorption treatments and/or furniture layouts are different, the measurements shall be conducted in each zone and the reported single-number quantities are determined for each zone separately.