DRAFT INTERNATIONAL STANDARD
ISO/DIS 16283-3

ISO/TC **43**/SC **2** | Secretariat: **DIN**

Voting begins on: **2014-06-12** | Voting terminates on: **2014-11-12**

Acoustics — Field measurement of sound insulation in buildings and of building elements —

Part 3:
Façade sound insulation

Acoustique — Mesurage in situ de l'isolation acoustique des bâtiments et des éléments de construction — Partie 3: Isolation des bruits de façades

ICS: 91.120.20;91.060.10

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Reference number
ISO/DIS 16283-3:2014(E)

Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 16283-3 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

Together with ISO 16283-1 this edition cancels and replaces ISO 140-5:1998 and ISO 140-14:2004 ISO 140-7:1998, and together with ISO 16283-2 this this edition cancels and replaces ISO 140-14:2004 of which have been technically revised.

ISO 16283 consists of the following parts, under the general title *Acoustics — Field measurement of sound insulation in buildings and of building elements*:

— *Part 1: Airborne sound insulation*

— *Part 2: Impact sound insulation*

— *Part 3: Façade sound insulation*

Introduction

ISO 16283 (all parts) describes procedures for field measurements of sound insulation in buildings. Airborne, impact and façade sound insulation are described in ISO 16283-1, ISO 16283-2 and ISO 16283-3, respectively.

Field sound insulation measurements that were previously described in ISO 140-4, -5, and -7 were (a) primarily intended for measurements where the sound field could be considered to be diffuse, and (b) not explicit as to whether operators could be present in the rooms during the measurement. ISO 16283 differs from ISO 140-4, -5, and -7 in that (a) it applies to rooms in which the sound field may, or may not approximate to a diffuse field, (b) it clarifies how operators can measure the sound field using a hand-held microphone or sound level meter and (c) it includes additional guidance that was previously contained in ISO 140-14.

Acoustics — Field measurement of sound insulation in buildings and of building elements — Part 3: Façade sound insulation

1 Scope

This part of ISO 16283 specifies procedures to determine the airborne sound insulation of facade elements (element methods) and whole facades (global methods) using sound pressure measurements. These procedures are intended for room volumes in the range from 10 m^3 to 250 m^3 in the frequency range from 50 Hz to 5 000 Hz.

The test results can be used to quantify, assess and compare the airborne sound insulation in unfurnished or furnished rooms where the sound field may, or may not approximate to a diffuse field. The measured airborne sound insulation is frequency-dependent and can be converted into a single number quantity to characterise the acoustic performance using the rating procedures in ISO 717-1.

The element methods aim to estimate the sound reduction index of a façade element, for example a window. The most accurate element method uses a loudspeaker as an artificial sound source. Other, less accurate, element methods use available traffic noise. The global methods, on the other hand, aim to estimate the outdoor/indoor sound level difference under actual traffic conditions. The most accurate global methods use the actual traffic as sound source. A loudspeaker may be used as an artificial sound source when there is insufficient level from traffic noise inside the room. An overview of the methods is given in Table 1.

The element loudspeaker method yields an apparent sound reduction index which, under certain circumstances can be compared with the sound reduction index measured in laboratories in accordance with ISO 10140. This method is the preferred method when the aim of the measurement is to evaluate the performance of a specified façade element in relation to its performance in the laboratory.

The element road traffic method will serve the same purposes as the element loudspeaker method. It is particularly useful when, for different practical reasons, the element loudspeaker method cannot be used. These two methods will often yield slightly different results. The road traffic method tends to result in lower values of the sound reduction index than the loudspeaker method. In Annex D this road traffic method is supplemented by the corresponding aircraft and railway traffic methods.

The global road traffic method yields the real reduction of a façade in a given place relative to a position 2 m in front of the façade. This method is the preferred method when the aim of the measurement is to evaluate the performance of a whole façade, including all flanking paths, in a specified position relative to nearby roads. The result cannot be compared with that of laboratory measurements.

The global loudspeaker method yields the sound reduction of a façade relative to a position that is 2 m in front of the façade. This method is particularly useful when, for practical reasons, the real source cannot be used, however the result cannot be compared with that of laboratory measurements.

Table 1 — Overview of the different measurement methods

No.	Method Element	Reference in this part of ISO 16283	Result	Field of application
1	Element loudspeaker	9.5	$R'_{45°}$	Preferred method to estimate the apparent sound reduction index of facade elements
2	Element road traffic	10.3	$R'_{\mathrm{tr,s}}$	Alternative to method No.1 when road traffic as a sound source provides a sufficient level
3	Element railway traffic	Annex E	$R'_{\mathrm{rt,s}}$	Alternative to method No.1 when railway traffic as a sound source provides a sufficient level
4	Element air traffic	Annex E	$R'_{\mathrm{at,s}}$	Alternative to method No.1 when air traffic as a sound source provides a sufficient level
	Global			
5	Global loudspeaker	9.6	$D_{\mathrm{ls,2m,n}T}$ $D_{\mathrm{ls,2m,n}}$	Alternative to methods Nos. 6, 7 and 8
6	Global road traffic	10.4	$D_{\mathrm{tr,2m,n}T}$ $D_{\mathrm{tr,2m,n}}$	Preferred method to estimate the global sound insulation of a facade exposed to road traffic as a sound source
7	Global railway traffic	Annex E	$D_{\mathrm{rt,2m,n}T}$ $D_{\mathrm{rt,2m,n}}$	Preferred method to estimate the global sound insulation of a facade exposed to railway traffic as a sound source
8	Global air traffic	Annex E	$D_{\mathrm{at,2m,n}T}$ $D_{\mathrm{at,2m,n}}$	Preferred method to estimate the global sound insulation of a facade exposed to air traffic as a sound source

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.

ISO 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation*

ISO 3382-2, *Acoustics — Measurement of room acoustic parameters — Part 2: Reverberation time in ordinary rooms*

ISO 12999-1, *Determination and application of uncertainties in building acoustics — Part 1: Sound insulation*

ISO 15712-3, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound.*

ISO 18233, *Acoustics — Application of new measurement methods in building and room acoustics*

IEC 60942, *Electroacoustics — Sound calibrators*

IEC 61183, *Electroacoustics — Random-incidence and diffuse-field calibration of sound level meters*

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.

3.1
average outdoor sound pressure level on the test surface
$L_{1,s}$
ten times the common logarithm of the ratio of the surface and time average of the squared sound pressure to the square of the reference sound pressure, the surface average being taken over the entire test surface including reflecting effects from the test specimen and façade

Note 1 to entry: $L_{1,s}$ is expressed in decibels.

3.2
average outdoor sound pressure level at a distance 2m in front of the facade
$L_{1,2m}$
ten times the common logarithm of the ratio of the time average of the squared sound pressure to the square of the reference sound pressure, at a position 2 m in front of the facade

Note 1 to entry: $L_{1,2m}$ is expressed in decibels.

3.3
energy-average sound pressure level in a room
L_2
ten times the common logarithm of the ratio of the space and time average of the squared sound pressure to the square of the reference sound pressure, the space average is taken over the central zone of the room where the direct radiation from any loudspeaker or the nearfield radiation from the room boundaries has negligible influence

Note 1 to entry: L_2 is expressed in decibels.

3.4
corner sound pressure level in a room
$L_{2,Corner}$
ten times the common logarithm of the ratio of the highest time average squared sound pressure from the set of corner measurements to the square of the reference sound pressure, for the low-frequency range (50, 63, and 80 Hz one-third octave bands)

Note 1 to entry: $L_{2,Corner}$ is expressed in decibels.

3.5
low-frequency energy-average sound pressure level in a room
$L_{2,\mathrm{LF}}$
ten times the common logarithm of the ratio of the space and time average of the squared sound pressure to the square of the reference sound pressure in the low-frequency range (50 Hz, 63 Hz, and 80 Hz one-third octave bands) where the space average is a weighted average that is calculated using the room corners where the sound pressure levels are highest and the central zone of the room where the direct radiation from any loudspeaker or the nearfield radiation from the room boundaries has negligible influence

Note 1 to entry: $L_{2,\mathrm{LF}}$ is expressed in decibels.

Note 2 to entry: $L_{2,\mathrm{LF}}$ is an estimate of the energy-average sound pressure level for the entire room volume.

3.6
reverberation time
T
time required for the sound pressure level in a room to decrease by 60 dB after the sound source has stopped

Note 1 to entry: T is expressed in seconds.

3.7
background noise level
measured sound pressure level in the receiving room from all sources except the sound source used for the measurement

3.8
fixed microphone
microphone that is fixed in space by using a device such as a tripod so that it is stationary

3.9
mechanized continuously-moving microphone
microphone that is mechanically moved with approximately constant angular speed in a circle, or is mechanically swept along a circular path where the angle of rotation about a fixed axis is between 270° and 360°

3.10
manually-scanned microphone
microphone attached to a hand-held sound level meter or an extension rod that is moved by a human operator along a prescribed path

3.11
manually-held microphone
microphone attached to a hand-held sound level meter or a rod that is hand-held at a fixed position by a human operator at a distance at least an arm's length from the trunk of the operator's body

3.12
apparent sound reduction index
$R'_{45°}$
measure of the airborne sound insulation of a building element when the sound source is a loudspeaker at an angle of incidence is 45° and the outside microphone position is on the test surface, which is given by ten times the common logarithm of the ratio of the sound power, $W_{1,45°}$, which is incident on a test element when the angle of sound incidence is 45° to the total sound power radiated into the receiving room if, in addition to the sound power, W_2, radiated by the test element, the sound power, W_3, radiated by flanking elements or by other components, is significant

$$R'_{45°} = 10 \lg \frac{W_{1,45°}}{W_2 + W_3} \quad (1)$$

for which the apparent sound reduction index is evaluated using Formula (4)

$$R'_{45^\circ} = L_{1,s} - L_2 + 10\lg\frac{S}{A} - 1{,}5\,\mathrm{dB} \tag{2}$$

where

S is the area of the test specimen, in square metres, determined as given in Annex A;

A is the equivalent absorption area of the receiving room, in square metres.

Note 1 to entry: R'_{45° is expressed in decibels.

Note 2 to entry: In general, the sound power transmitted into the receiving room consists of the sum of several components from different elements (window, ventilator, door, wall etc).

Note 3 to entry: Formula (2) is based on the assumption that the sound is incident from one angle only, 45°, and the sound field in the receiving room approximates to a diffuse field.

3.13
apparent sound reduction index
$R'_{tr,s}$
measure of the airborne sound insulation of a building element when the sound source is road traffic and the outside microphone position is on the test surface for which the apparent sound reduction index is evaluated using Formula (4)

$$R'_{tr,s} = L_{1,s} - L_{2,s} + 10\lg\frac{S}{A} - 3\,\mathrm{dB} \tag{3}$$

where

S is the area of the test specimen, in square metres, determined as given in Annex A;

A is the equivalent absorption area of the receiving room, in square metres.

Note 1 to entry: $R'_{tr,s}$ is expressed in decibels.

Note 2 to entry: Formula (3) is based on the assumption that the sound is incident from all angles, and the sound field in the receiving room approximates to a diffuse field.

3.14
level difference
D_{2m}
level difference between $L_{1,2m}$ and L_2 evaluated using Formula (4)

$$D_{2m} = L_{1,2m} - L_2 \tag{4}$$

Note 1 to entry: D_{2m} is expressed in decibels.

Note 2 to entry: The notation is $D_{tr,2m}$ when traffic noise is used as the sound source, and $D_{ls,2m}$ when a loudspeaker is used.

3.15
standardized level difference
$D_{2m,nT}$
level difference that is standardized to a reference value of the reverberation time in the receiving room and calculated using Formula (5)

$$D_{2m,nT} = D_{2m} + 10\lg\frac{T}{T_0} \quad (5)$$

where

T is the reverberation time in the receiving room;

T_0 is the reference reverberation time; for dwellings, T_0 = 0,5 s.

Note 1 to entry: $D_{2m,nT}$ is expressed in decibels.

Note 2 to entry: The level difference is referenced to a reverberation time of 0,5 s because in dwellings with furniture the reverberation time has been found to be reasonably independent of volume and frequency and to be approximately equal to 0,5 s.

Note 3 to entry: The notation is $D_{tr,2m,nT}$ when traffic noise is used as the sound source, and $D_{ls,2m,nT}$ when a loudspeaker is used.

3.16
normalized level difference
$\boldsymbol{D_{2m,n}}$
level difference that is normalized to a reference value of the absorption area in the receiving room and calculated using Formula (6)

$$D_{2m,n} = D_{2m} - 10\lg\frac{A}{A_0} \quad (6)$$

where

A_0 is the reference absorption area; for dwellings, A_0 = 10 m^2.

Note 1 to entry: $D_{2m,n}$ is expressed in decibels.

Note 2 to entry: The notation is $D_{tr,2m,n}$ when traffic noise is used as the sound source, and $D_{ls,2m,n}$ when a loudspeaker is used.

3.17
equivalent absorption area
$\boldsymbol{A}$
sound absorption area which is calculated using Sabine's formula in Formula (7)

$$A = \frac{0{,}16V}{T} \quad (7)$$

where

V is the receiving room volume, in cubic metres;

T is the reverberation time in the receiving room.

Note 1 to entry: A is expressed in square metres.

3.18
single event level
$\boldsymbol{L_E}$
single event level of a discrete noise event calculated using Formula (8)

