INTERNATIONAL STANDARD

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Acoustics — Measurement of office screen sound attenuation under specific laboratory conditions

Acoustique — Mesurage, dans des conditions de laboratoire spécifiques, de l'affaiblissement acoustique apporté par les écrans utilisés dans les bureaux

Reference number
ISO 10053:1991(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.

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 10053 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Sub-Committee SC 2, *Building acoustics*.

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

International Organization for Standardization
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Acoustics — Measurement of office screen sound attenuation under specific laboratory conditions

1 Scope

This International Standard gives a method for measuring the sound attenuation of screens intended for use in rooms to increase speech privacy or noise insulation between working positions.

Screen sound attenuation measured according to this International Standard is intended to be used to classify screens.

NOTE 1 Field conditions will, as a rule, deviate from the conditions specified in this method. Reflections from ceilings and walls can considerably lower the apparent screen sound attenuation.

The classification obtained according to this International Standard is not valid in those practical situations where the source is situated close to the floor. The directivity of the actual sound source and the sound transmission properties of the screen produce results that differ from those obtained by use of the method given in this International Standard.

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 indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3745:1977, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.*

IEC 225:1966, *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations.*

IEC 651:1979, *Sound level meters.*

IEC 804:1985, *Integrating-averaging sound level meters.*

3 Definitions

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

3.1 screen, screen element: Partial height space divider that is intended for use in large rooms without partitions. A screen may consist of several screen elements coupled together.

3.2 screen sound attenuation: Sound attenuation measured according to this International Standard. The quantity is denoted by ΔL_s. For a screen with no air gap at the floor, ΔL_s is an approximation of the insertion loss that would have been obtained in a free field with a corresponding screen of infinite width and semi-infinite height.

4 Equipment

The measurement equipment shall comply with IEC 651 for a type 1 sound level meter. Integrating sound level meters shall comply with IEC 804. The microphone diameter shall have a maximum dimension of 13 mm (1/2 in). The filters shall comply with IEC 225.

If the loudspeaker contains multiple loudspeaker elements, their axes shall coincide.

It is essential that the directivity of the loudspeaker lies within one of the ranges given in table 1 when excited with pink noise and measured in octave bands.

Table 1

Octave band frequency	Deviations in sound pressure level[1]		
	0°	± 10° and ± 20°	± 30° and ± 40°
Hz	dB		
125, 250	Ref.	± 0,5	± 0,5
500	Ref.	+ 0,5 − 1,0	+ 0,5 − 1,0
1 000	Ref.	+ 0,5 − 1,0	− 1,0 − 2,5
2 000, 4 000	Ref.	0 − 2,0	− 1,5 − 3,5

1) For the given ranges of directivity.

These requirements will probably be fulfilled by a single element loudspeaker with an element diameter not exceeding 0,13 m.

NOTE 2 In this specific kind of measurement, it is not desirable to have a perfectly omnidirectional sound source. In the absence of an anechoic chamber, the directivity may be determined according to the method given in annex A.

5 Test facility

5.1 General

The test shall be carried out under free-field conditions above a reflecting plane. Below the screen under test, the reflecting plane shall be flat giving a stated gap under the screen with a tolerance of ± 5 mm.

5.2 Indoors

The preferred test facility is a hemi-anechoic room in accordance with ISO 3745, i.e. a room with negligible reflections from the walls and ceilings in the frequency range of the measurements.

The floor shall be of a solid material such as concrete or plywood weighing at least 20 kg/m^2. It shall not be covered by a carpet. The ceiling of the test facility shall be at least 0,6 m from the top of the screen to be tested.

The minimum effective length of the facility shall be 5 m. The width shall be at least 4 m or such that side diffraction does not affect the result by more than ± 0,5 dB.

5.3 Outdoors

If a preferred indoors test facility is not available the test may be carried out in the open. It is important that reflections from objects other than the test object do not influence the measurements. The background noise level at the microphone position shall be at least 10 dB below the sound pressure level in each octave band with the sound source operating. The wind speed at the test site shall be less than 5 m/s. A microphone windscreen shall be used.

6 Test specimen

6.1 General

As the screen sound attenuation may depend on the joints between the screen elements and the size of the air gap under the screen, specified values can be obtained only by measuring every actual size of screen element and air gap.

If a screen has only one absorbing side, this side shall face the source. Curved screens with identical sides shall be positioned with the concave side facing the source.

6.2 Outdoors

With reference to figure 1, the total width of a free-standing screen consisting of several screen elements, A, with width e, shall be either

a) at least $d + e$, where d is obtained from figure 2, or

b) another arrangement if it can be shown that the side diffraction does not affect the result by more than ± 0,5 dB.

NOTE 3 The height h includes the height of any feet supporting the screen.

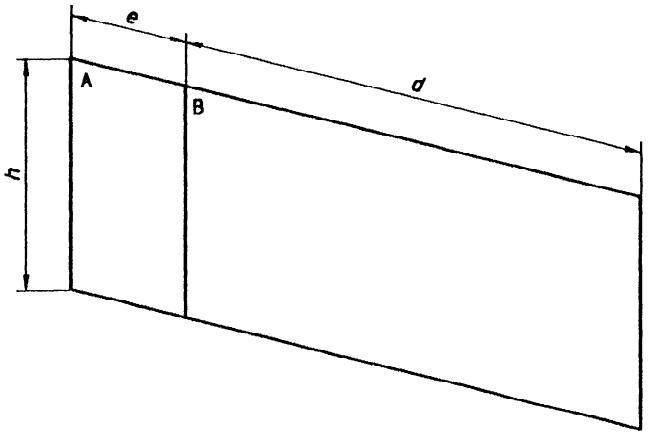

Figure 1 — Geometry of the screen

Dimensions in metres

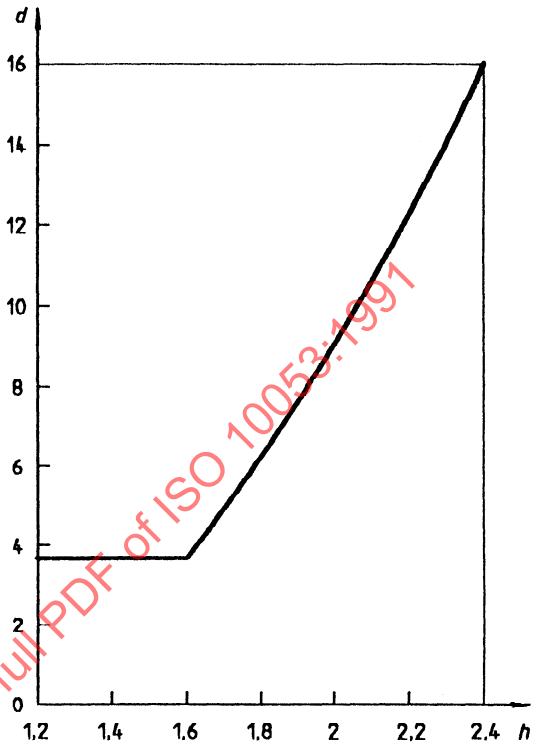

Figure 2 — Minimum width of Part B of the screen shown in figure 1

6.3 Indoors

Indoors reduce the side diffraction, and thus the width of the screen, by sealing the gap between the screen and the walls of the test facility.

NOTE 4 Due to the characteristics of sound absorbing walls, it is difficult to reduce the side diffraction altogether. If it can be shown that the side diffraction does not affect the result by more than ± 0,5 dB, the total width of the screen may be reduced accordingly.

7 Test procedure

7.1 Test arrangement

The test arrangement is shown in figure 3.

Place the loudspeaker with its axis perpendicular to the screen at a height 1,2 m above the floor and with the diaphragm surface 1,5 m from the source side of the screen. If the screen is curved, this distance shall be the distance to the source side of the screen at the position of the joint through which the loudspeaker axis passes, as specified below.

Ensure that the loudspeaker axis passes through the middle of a joint between two screen elements. Choose the width of the screen so as to minimize the effect of diffraction around the vertical side edges of the screen. This means that the distance between the joint and the two side edges shall differ by at least 0,6 m and that the smallest distance shall be at least equal to $d/2$ (see figure 2).

Place the standard microphone on the loudspeaker axis 1,5 m from the receiver side of the screen.

The reference microphone position shall be where the vertical plane through the loudspeaker axis intersects the top edge of the screen, closest to the loudspeaker. During the reference measurements, the screen shall be absent.

In both microphone positions, the reference direction of the microphone, as defined in IEC 651, shall be directed towards the loudspeaker.

Values in metres

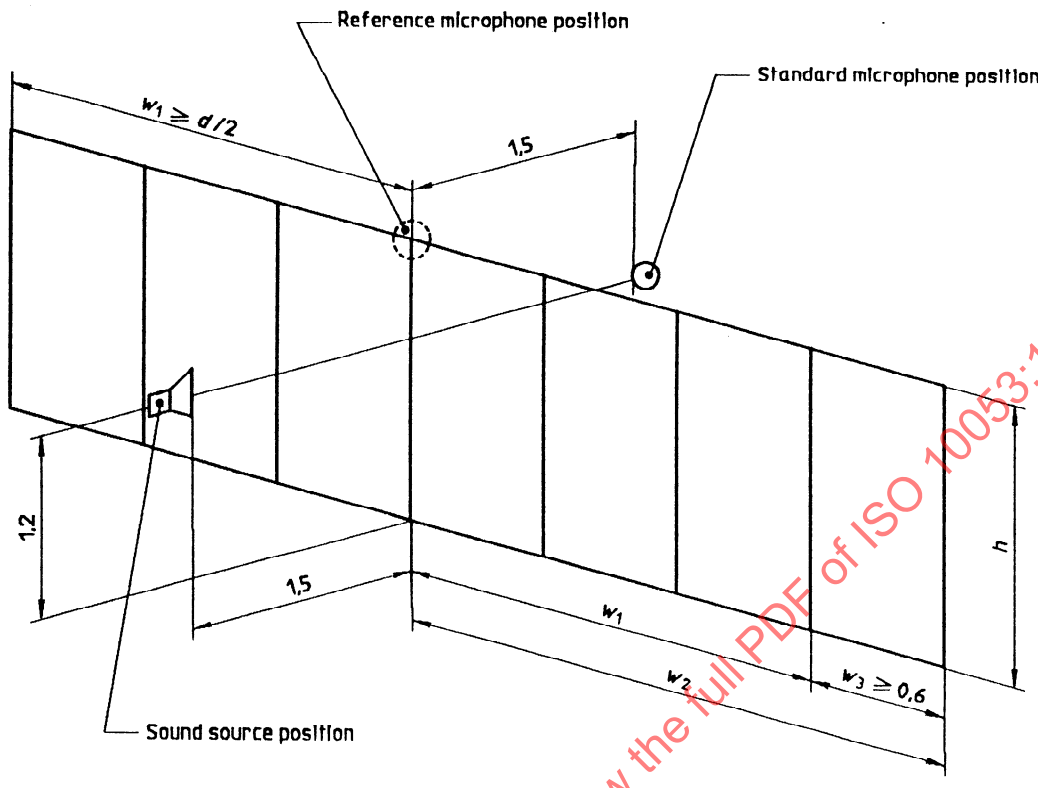

Figure 3 — Test arrangement

7.2 Measurements

Carry out measurements in octave bands in the frequency range 125 Hz to 4 000 Hz, using an effective averaging time of at least 16 s.

After the first measurement series on the screen, change the positions of the two screen elements next to the measurement joint without turning them through 180°, and repeat the measurements. If the difference for any frequency band between the two measurement series exceeds 2 dB, repeat the measurements in the same way with new screen elements next to the joint, until the maximum difference, in decibels, is less than the number of measurements. The measurement value to be used is the calculated average value of all the different measurements.

NOTE 5 As a guidance, the screen sound attenuation provided by a rigid thin screen is given in annex C for various screen heights.

8 Calculation of the screen sound attenuation

Calculate the screen sound attenuation ΔL_s, in decibels, by using equation (1)

$$\Delta L_s = L_{p_o} - L_p - 20 \lg(R/r) \text{ dB} \quad \ldots (1)$$

where

L_{p_o} is the sound pressure level at the reference position, in decibels;

L_p is the sound pressure level at the standard position averaged over the number of measurements carried out, in decibels;

R is the distance between the source and standard position, in metres ($R = 3{,}0 + t$, where t is the screen thickness, in metres);

r is the distance between the source and reference position, in metres.

If required, make a single number rating according to annex B.

9 Precision

9.1 Repeatibility

The measurement procedure is expected to give the following repeatability:

125 Hz :	better than 1,5 dB
250 Hz to 4 000 Hz :	better than 1,0 dB

9.2 Reproducibility

No data are available at present.

10 Expression of results

State ΔL_s in the form of a table and a graph. Before presentation, round the values to the nearest whole decibel.

For graphs with the sound level, in decibels, plotted against frequency, in herz, on a logarithmic scale, the following dimensions shall be used:

15 mm for an octave;

20 mm for 10 dB.

11 Test report

The test report shall include:

a) reference to this International Standard;

b) name and address of the testing laboratory;

c) identification number of the test report;

d) name and address of the organization of the person who ordered the test (optional);

e) name and address of manufacturer or supplier of the tested object;

f) method of sampling and other circumstances;

g) conditioning of the test specimens;

h) a description of the screen including its width, height and the distance between the lower edge of the screen and the floor; the number and size of screen elements; the coupling arrangement between elements; a detailed description of a screen element including its frame and its surface treatment on both sides;

i) a description of the sound source including its directivity pattern;

j) identification of the test equipment and instruments used;

k) a description of the measurement site;

l) environmental data during the test (temperature, relative humidity, etc.);

m) test results;

n) date of the test and signature of person responsible.

Annex A
(informative)

Simplified method to determine the directivity of the sound source

A.1 Introduction

Because of interference effects, directivity measurements in the vertical plane cannot take place close to a reflective horizontal plane. However, for measurements performed in the horizontal plane, these effects will be the same for all angles.

Possible errors are small as the distances are not very critical. High frequencies will have uncorrelated ground reflections and low frequencies will have wavelengths much larger than possible distance errors.

A.2 Method

The sound source is mounted in its normal position 1,2 m above the reflective surface. The microphone is placed on the horizontal loudspeaker axis 1,0 m from the loudspeaker diaphragm. This position is the 0° reference position. The measurements are then carried out, either by turning the loudspeaker or by moving the microphone along a circular path in the horizontal plane. Apart from the reference position, the measurement points are obtained (assuming a fixed microphone) by turning the loudspeaker $\pm$ 10°, $\pm$ 20°, $\pm$ 30° and $\pm$ 40°, respectively.