BRITISH STANDARD

BS EN 20140-10:1992
ISO 140-10: 1991

Acoustics — Measurement of sound insulation in buildings and of building elements —

Part 10: Laboratory measurement of airborne sound insulation of small building elements

The European Standard EN 20140-10:1992 has the status of a British Standard

UDC 699.844:534.6:534.83:620.1

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Contents

National foreword

This British Standard has been prepared under the direction of the Environment and Pollution Standards Policy Committee. It is the English language version of EN 20140-10:1992 *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 10: Laboratory measurement of airborne sound insulation of small building elements*, published by the European Committee for Standardization (CEN), which endorses ISO 140-10:1991 *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 10: Laboratory measurement of airborne sound insulation of small building elements*, published by the International Organization for Standardization (ISO).

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

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EN 20140-10

July 1992

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Descriptors: Acoustics, acoustic insulation, buildings, structural members, acoustic tests, laboratory tests, acoustic measurements, airborne sound

English version

Acoustics — Measurement of sound insulation in buildings and of building elements — Part 10: Laboratory measurement of airborne sound insulation of small building elements

(ISO 140-10:1991)

Acoustique — Mesurage de l'isolation acoustique des immeubles et des éléments de construction —
Partie 10: Mesurage en laboratoire de l'isolation au bruit aérien de petits éléments de construction
(ISO 140-10:1991)

Akustik — Messung der Schalldämmung in Gebäuden und von Bauteilen —
Teil 10: Messung der Luftschalldämmung kleiner Bauteile in Prüfständen
(ISO 140-10:1991)

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

Foreword

Following the positive result of the Unique Acceptance Procedure, CEN has adopted the International Standard ISO 140-10:1991 *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 10: Laboratory measurement of airborne sound insulation of small building elements*.

This European Standard has been drawn up in order to comply with the request of the Standing Committee for construction following Council Directive 89/106/EEC on construction products and the provisional mandate "Protection against noise" (BC/CEN 08/1991) related to it and issued by EEC and EFTA.

In the countries bound to implement this European Standard a national standard identical to this European Standard shall be published at the latest by 1993-01-31 and conflicting national standards shall be withdrawn at the latest by 1992-01-31.

In accordance with the CEN/CENELEC Common Rules the following countries are bound to implement this European Standard:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This part of ISO 140 gives a laboratory method of measuring airborne sound insulation under diffuse field conditions of such small building elements as are defined below.

It is intended that the results obtained will be used to develop building elements with appropriate acoustical properties, to classify such elements according to their sound insulation properties and to estimate their influence on the sound insulation of partition constructions in buildings.

This part of ISO 140 applies to building elements, excluding windows and doors, with an area of less than 1 m^2 and which occur in a certain number of discrete sizes with well-defined lateral dimensions and which transmit sound between two adjacent rooms or between one room and the open air independently of the adjoining building elements.

Some examples of equipment covered by this part of ISO 140 are

transfer air devices

airing panels (ventilators)

outdoor air intakes

electrical raceways (cable ducts)

transit sealing systems

The method given is not primarily intended for components that constitute part of an integrated unit for which the associated sound transmission might depend on an interplay of components.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 140. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 140 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 140-1:1990, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 1: Requirements for laboratories.*

ISO 140-3:1978, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 3: Laboratory measurements of airborne sound insulation of building elements.*

ISO 717-1:1982, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation in buildings and of interior building elements.*

ISO 717-3:1982, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 3: Airborne sound insulation of facade elements and facades.*

3 Definition

For the purposes of this part of ISO 140, the following definition applies.

3.1
element-normalized level difference

for the purposes of this test method, the element-normalized level difference is given by equation (1). It is denoted by $D_{n,e}$ and is expressed in decibels

$$D_{n,e} = L_1 - L_2 + 10 \lg (A_0/A) \text{ dB} \quad \ldots (1)$$

where

L_1 is the average sound pressure level in the source room, in decibels;

L_2 is the average sound pressure level in the receiving room, in decibels;

A_0 is the reference area, in square metres (for the laboratory, $A_0 = 10$);

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

4 Equipment

The measurement equipment shall comply with the requirements given for equipment in ISO 140-3.

5 Laboratory requirements

5.1 Rooms

Laboratory test facilities shall comply with the requirements given for laboratory test facilities in ISO 140-1.

5.2 Partitions

The test object is much smaller than the available test opening. A partition of sufficiently high sound insulation shall be built in the test opening; the object shall be placed in this partition. The sound transmitted through this partition and any other indirect path shall be either:

a) negligible compared with the sound transmitted through the test object,

or, if this condition cannot be filled,

b) the measured values shall be corrected for the influence of flanking transmission.

The flanking transmission shall be determined by measuring the apparent sound insulation of the partition wall inserted in the test opening. This measurement can be carried out before making the opening for the test object or with plates having a high sound insulation on both sides of the opening.

It is convenient to express this sound insulation in terms of the element-normalized level difference according to equation (1). The flanking transmission expressed as an equivalent $D_{n,e}$ is denoted by $D_{n,e,F}$.

If the measured value of the element-normalized level difference for a test object is less than $D_{n,e,F} - 10$ dB, the indirectly transmitted sound is considered negligible. If the measured value is larger than or equal to $D_{n,e,F} - 10$ dB, the measured value shall be corrected using the procedure specified in Annex A.

NOTE 1 Difficulties with an unsatisfactorily low margin between the flanking transmission and the transmission via the test object can be avoided by increasing the number of test objects inserted in the partition (see **6.3.3**).

6 Installation and operation of test objects

6.1 General

As the sound insulation of small building elements depends on their dimensions, reliable values can be obtained only by testing every actual size.

6.2 Mounting of test objects

Ensure that the test object is installed in a manner representative of field practice with a careful simulation of normal connections and sealing conditions at the perimeter and at joints within the unit.

If the test object is intended to be openable, install it for test so that it can be opened and closed in the normal manner. Open and close it at least ten times immediately before testing.

In order to achieve a realistic wall thickness around the element, it might be practical or necessary either to increase or decrease the thickness of the partition wall in the area around the element. Rules for increasing or decreasing the thickness locally are given in Annex B.

6.3 Location of test objects

6.3.1 *Mounting positions*

When a small building unit is mounted near one or more reflecting planes, the sound transmission may differ appreciably from that obtained when the unit is mounted through a partition but away from any adjoining room surface. Therefore, mount the equipment to be tested through the partition in positions representative of normal usage. On devices which can be used at several different positions, carry out measurements at least with an edge present in both rooms.

For transfer air devices and electrical raceways which are normally mounted near an adjoining reflective wall, the specific mounting positions are stated in **6.4** and **6.5**. For other types of equipment, the rules given in **6.3.1.1** to **6.3.1.3** shall be observed.

6.3.1.1 *Equipment used away from walls*

Install equipment mounted through a partition but normally located away from an adjoining wall, floor or ceiling in such a manner that no part is within 1,00 m of a surface at right angles to the mounting surface; 0,85 m will be sufficient if several elements are tested at the same time.

6.3.1.2 *Equipment used near an edge*

Locate equipment mounted through a partition and normally located near an adjoining wall, floor or ceiling, and away from a corner, at least 1,00 m (0,85 m if several elements are tested at the same time) from the nearest wall not being a part of the edge. Unless otherwise specified by the manufacturer, locate the edge of the equipment 0,1 m from the edge of the wall.

6.3.1.3 *Equipment used near a corner*

Locate equipment mounted through a partition and normally located near a corner at the distance from a corner recommended by the manufacturer.

If natural corners or edges are not available in the test opening, it is essential to simulate such mounting conditions by means of attaching reflective panels at right angles to the partition wall, as illustrated in Annex C. Ensure that the simulation takes place both in the receiving and the source room.

6.3.2 *Number of positions*

The building elements are small and, in combination with the spatial variations of the sound fields, this leads to a significant position dependency. Use preferably three positions for the mounting of the test object in the partition wall. These positions shall either

a) be simulated as described in **6.3.1**, or

b) they shall be located at least 1,2 m from each other.

NOTE 2 A position dependency also exists for apparently equivalent corners which makes it necessary to use more than one corner to achieve an acceptable precision.

NOTE 3 When simulating corner or edge positions by attaching reflective panels, it is possible to achieve the necessary position averaging by changing the locations and orientations of the additional panels.

6.3.3 *Number of small elements*

To achieve a better signal-to-noise ratio, simultaneous measurements can be performed on more than one test object. When performing simultaneous measurements, replace equation (1) by

$$D_{n,e} = L_1 - L_2 + 10 \lg [(nA_0)/A] \text{ dB} \quad \ldots (2)$$

where

$D_{n,e}$ is the element-normalized level difference of the individual element;

n is the number of units installed.

6.4 Installation of transfer air devices

Install the test objects in a manner representative of field practice and in typical locations with respect to the room surfaces as given in the installation rules above. Mount transfer air devices which are normally mounted near an adjoining ceiling in a position close to a reflective surface at right angles to the partition, but at least 1,00 m (0,85 m if several elements are tested at the time) from any corner. The distance between the closest part of the device and the adjoining surface shall be 0,1 m. Accessories normally used shall be included. Position and fix these accessories in accordance with the manufacturer's directions.

If the device is provided with some air-flow control, ensure that the equipment is operated in a specified manner typical of normal usage. If the specified manner is not the fully open condition, include this condition in the test sequence.

If the device is continuously adjustable to various wall thicknesses, ensure that the tests comprise at least the two extreme wall thicknesses for which the device is stated to be suitable.

6.5 Installation of electrical raceways

Install the test object in a manner representative of field practice and in typical locations with respect to the room surfaces. Mount raceways which are normally mounted directly on walls on a reflective surface at right angles to the partition and in accordance with the manufacturer's directions. Include accessories normally used. Install these accessories in accordance with the manufacturer's instructions.

Install the test object with an exposed continuous duct length of at least 2 m, both in the source and in the receiver room. Provide the exposed duct ends with standard end covers.

Soundproofing accessories to be used in installations through partition walls are often available in raceways. To test practical sealing and insulating properties of such soundproofing accessories, it is recommended that the raceway be filled to its rated capacity with cables.

NOTE 4 The acoustical performance can vary with the number of cables.

If the edge mounting is simulated with additional panels, ensure that the panel length is at least as large as the duct length.

7 Test procedure and evaluation

Ensure that the laboratory procedures comply with the relevant clauses of ISO 140-3.

8 Precision

The precision is equivalent to that given in ISO 140-3.

9 Expression of results

For the statement of the airborne sound insulation of the test specimen, the values of $D_{n,e}$ shall be given at all frequencies of measurement, in tabular form and/or in the form of a curve. For graphs with the level in decibels plotted against frequency on a logarithmic scale, the following dimensions shall be used:

5 mm for the one-third octave band;

20 mm for 10 dB.

In addition, give the weighted element-normalized level difference $D_{n,e,w}$. Calculate $D_{n,e,w}$ as specified for single-number quantities in either ISO 717-1 or ISO 717-3.

10 Test report

The test report shall state:

a) reference to this part of ISO 140;

b) name and address of the testing laboratory;

c) identification number of the test report;

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

e) method of sampling and other circumstances;

f) name and address of manufacturer or supplier of the test object;

g) description of the tested object (test specimen), including type and size, with sectional drawing and operation conditions;

h) date of the test;

i) conditioning of the test specimen and environmental data during the test (e.g. temperature);

j) identification of the test equipment and instruments used, volumes of both the source room and the receiving room, description of mounting conditions, including the location of the test object in the partition wall and the distances to adjoining walls, floor, ceiling and reflective panels;

k) element-normalized level difference of the test specimen as a function of frequency. If the measured value has been affected by flanking transmission, the value of $D_{n,e,F}$ should be given and those results which have been obtained by correcting for the influence of flanking transmission should be indicated;

l) inaccuracy or uncertainty of the test results (e.g limit of measurement when the unit insulation in any band is not measurable on account of background noise or flanking transmission);

m) date of test, and signature of person responsible.

Annex A (normative)
Correction of flanking transmission

Compare the results $D_{n,e,M}$ of measurements on small building elements with the results $D_{n,e,F}$ representing the flanking transmission, that is the partition wall without holes for the small building elements. If the difference $D_{n,e,F} - D_{n,e,M}$ is greater than or equal to 6 dB but smaller than 10 dB, the result of the measurement $D_{n,e}$, in decibels, is given by

$$D_{n,e} = 10 \lg \frac{1}{\left(10^{\,D_{n,e,M}/10} - 10^{\,D_{n,e,F}/10}\right)} \text{ dB} \qquad \text{(A.1)}$$

where

$D_{n,e}$ is the corrected element-normalized level difference of the test specimen;

$D_{n,e,M}$ is the uncorrected element-normalized level difference including flanking transmission through the test specimen;

$D_{n,e,F}$ is measured with or without sealed openings for the test specimen.

If the difference $D_{n,e,F} - D_{n,e,M}$ is smaller than 6 dB in some of the frequency bands, the correction shall be 1,3 dB at the most, corresponding to a difference of 6 dB. In that case give $D_{n,e,F}$ in the test report (see clause **10**) so that it is apparent that the reported $D_{n,e}$ values are minimum values.

Annex B (normative)
Local changing of wall thickness

B.1 Local increase of wall thickness

Instead of changing the thickness of the complete partition wall, simulate various wall thicknesses by adding extra panels to the original partition construction. The edges of such additional panels shall be at least 0,5 m from any part of the test object.

B.2 Local decrease of wall thickness

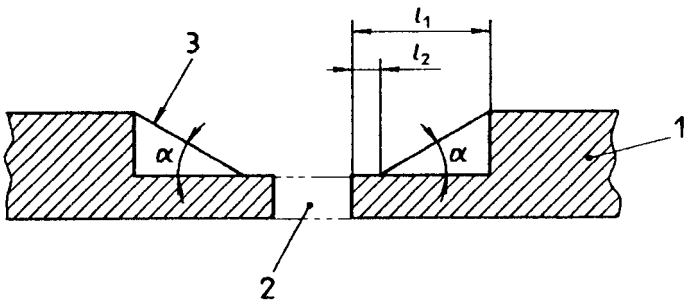
If a thick partition wall is needed to assure sufficiently high flanking transmission loss, create a realistic wall thickness around the test device by locally reducing the thickness. This shall be done according to Figure B.1.

The following relations shall hold:

$l_1 > 0{,}6$ m

$l_2 < 0{,}1$ m

$\alpha < 30°$



1 Position between test rooms
2 Test specimen
3 Auxiliary transition panels with mass per unit area more than 10 kg/m² and on inclination of $\alpha < 30°$. (The panels shall be sealed with tape along the edges.)

Figure B.1 — Local decrease of wall thickness

Annex C (normative) Simulation of corner and edge positions

The simulation of a corner is shown in Figure C.1. To simulate an edge, it is sufficient to use only one panel, the dimensions of which shall be at least 1,2 m × 2,4 m. The panels shall not be mounted parallel to the boundary surfaces of the room.

If it is necessary to use additional panels in both the source room and the receiving room, ensure that the locations and orientations of the panels are the same in both rooms.

The mass per unit area of the panels shall exceed 7 kg/m^2. Above 100 Hz, the sound absorption coefficient shall be less than 0,1.

Seal the connections between the panels and the partition wall with, for example, a heavy adhesive tape. As the mounting of additional panels to the partition wall might influence its transmission characteristics, include the various panel arrangements in the measurements of the flanking transmission.

Dimensions in metres

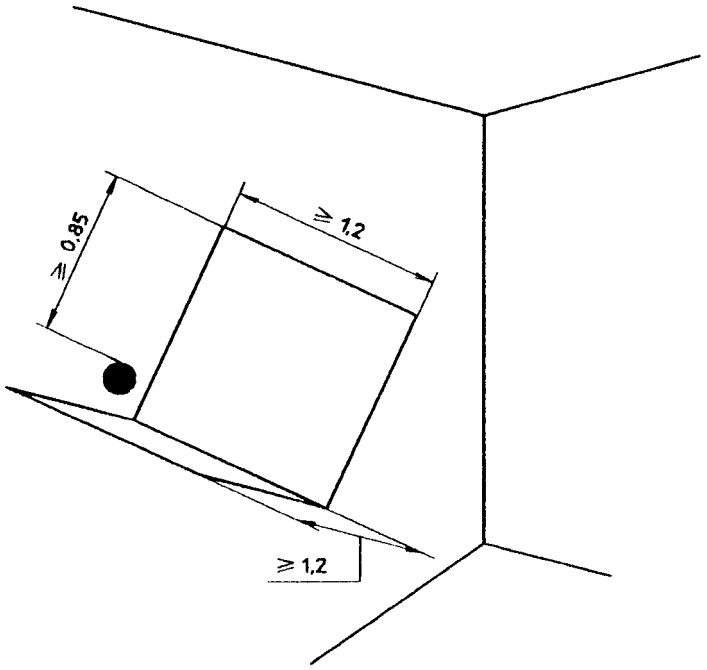


Figure C.1 — Drawing showing in principle how to simulate a corner position by attaching reflective panels at right angles to the partition wall mounted in the test opening

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National annex NA (informative)
Committees responsible

The United Kingdom participation in the preparation of this European Standard was entrusted by the Environment and Pollution Standards Policy Committee (EPC/-) to Technical Committee EPC/1 upon which the following bodies were represented:

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British Broadcasting Corporation
British Occupational Hygiene Society
British Telecommunications plc
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Department of the Environment (Building Research Establishment)
Department of Trade and Industry (Air Division)
Department of Trade and Industry (National Physical Laboratory)
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Aggregate Concrete Block Association
Association of Building Component Manufacturers
Association of Manufacturers of Domestic Unvented Supply Systems Equipment (MODUSSE)
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Calcium Silicate Brick Association Ltd.
Concrete Block Association
Concrete Society
Gypsum Products Development Association
Heriot-Watt University
Hevac Association
Suspended Ceilings Association

National annex NB (informative)
Cross-references

Publication referred to	Corresponding British Standard
ISO 140-3:1978	BS 2750 *Measurement of sound insulation in buildings and of building elements* Part 3:1980 *Laboratory measurements of airborne sound insulation of building elements* BS 5821 *Methods for rating the sound insulation in buildings and of building elements*
ISO 717-1:1982	Part 1:1984 *Method for rating the airborne sound insulation in buildings and of interior building elements*
ISO 717-3:1982	Part 3:1984 *Method for rating the airborne sound insulation of façade elements and façades*

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