BS EN 16487:2014

BSI Standards Publication

Acoustics — Test code for suspended ceilings — Sound absorption

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 16487:2014.

The UK participation in its preparation was entrusted to Technical Committee EH/1/6, Building acoustics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 79998 3

ICS 91.060.30; 91.120.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2014.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16487

November 2014

ICS 91.060.30; 91.120.20

English Version

Acoustics - Test code for suspended ceilings - Sound absorption

Acoustique - Code d'essai des plafonds suspendus - Absorption acoustique

Akustik - Prüfvorschrift für Unterdecken - Schallabsorption

This European Standard was approved by CEN on 27 September 2014.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 16487:2014) has been prepared by Technical Committee CEN/TC 126 “Acoustic properties of building elements and of buildings”, the secretariat of which is held by AFNOR.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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 May 2015, and conflicting national standards shall be withdrawn at the latest by May 2015.

This standard is a complement to the European Standard EN ISO 354 and is not intended to replace it. The complement includes more stringent rules, narrower tolerances and new, additional requirements to be used for compilation of data for the CE marking of suspended ceilings.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Product standard EN 13964 “Suspended ceilings — Requirements and test methods” provides information on how to mark or label products for the CE marking. When the suspended ceiling has a sound absorption property, its sound absorption coefficients should be established by testing according to EN ISO 354. The measured sound absorption coefficients are calculated into the practical sound absorption coefficient α_p, in octave bands and into a single number value α_w with shape indicator, in accordance with EN ISO 11654. The single number value α_w is used for the CE marking.

Measurement of sound absorption coefficients according to EN ISO 354 is through earlier RRTs (Round Robin Tests) known to generate large spread in results from different laboratories. This is not acceptable, either from a competition point of view or from an end-user perspective. Therefore, CEN/TC 126 “Acoustic properties of building elements and of buildings” decided to set up a working group, WG 11 “Test Code for suspended ceilings”, with the scope to improve reproducibility by developing a Test Code. One part of this work was to organize a Round Robin Test (RRT) for sound absorption measurements.

1 Scope

This European Standard specifies additional necessary information on how to carry out efficiently and under standardized conditions the determination of the sound absorption coefficients according to EN ISO 354 “Measurement of sound absorption in a reverberation room”. It specifies the additional requirements of the sound absorption measurements and the operating and mounting conditions that should be used for the test. Observe that all demands in EN ISO 354 still should be fulfilled. The results obtained are used for design calculations with respect to room acoustics and to convert frequency-dependent sound absorption coefficients into a weighted sound absorption coefficient α_w, according to EN ISO 11654.

This European Standard is applicable for the compile of the single number rating α_w, to express the sound absorption performance of suspended ceiling membranes in CE marking and labelling according to EN 13964. This European Standard is not applicable for suspended ceiling kits according to EN 13964.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13964:2014, *Suspended ceilings - Requirements and test methods*

EN ISO 354:2003, *Acoustics - Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 11654, *Acoustics - Sound absorbers for use in buildings - Rating of sound absorption (ISO 11654)*

NOTE Due to the strong links between this standard and EN ISO 354:2003 and EN 13964:2014, references to relevant paragraphs are given where applicable

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
test object
designation of a sound absorbing product being a part of a test specimen

3.2
test specimen
designation of all the test objects included in a measurement

3.3
area of the test specimen
S
area of the test objects creating the test specimen

Note 1 to entry The area is expressed in square metres with two decimals.

[SOURCE: EN ISO 354:2003, 3.8 modified – by replacing “floor or wall” with “test objects” and by deleting the second note related to test specimen surrounded by a structure]

3.4
suspended ceiling
ceiling hung by a suspension from or by a directly fixed substructure or perimeter trim to the load bearing structure (floor, roof, beam and walls) at a distance from the floor or roof above

[SOURCE: EN 13964:2014, 3.1.2]

3.5
ceiling membrane
exposed surface of the ceiling facing the room, excluding any exposed substructure

[SOURCE: EN 13964:2014, 3.3.1]

3.6
ceiling membrane component
product forming part of the ceiling membrane (e.g. a tile or plank)

[SOURCE: EN 13964:2014, 3.3.2]

3.7
suspended ceiling kit
set of at least two separate components that need to be put together to be installed permanently in the works

[SOURCE: EN 13964:2014, 3.1.4 modified – by deleting the sentence after the definition and the notes]

3.8
plane absorbers
horizontal objects (ceiling membrane components) creating a continuous surface (ceiling membrane)

3.9
baffles
discrete sound absorbers installed as vertical objects (ceiling membrane components) at a certain distance from each other

Note 1 to entry: see Figure 1

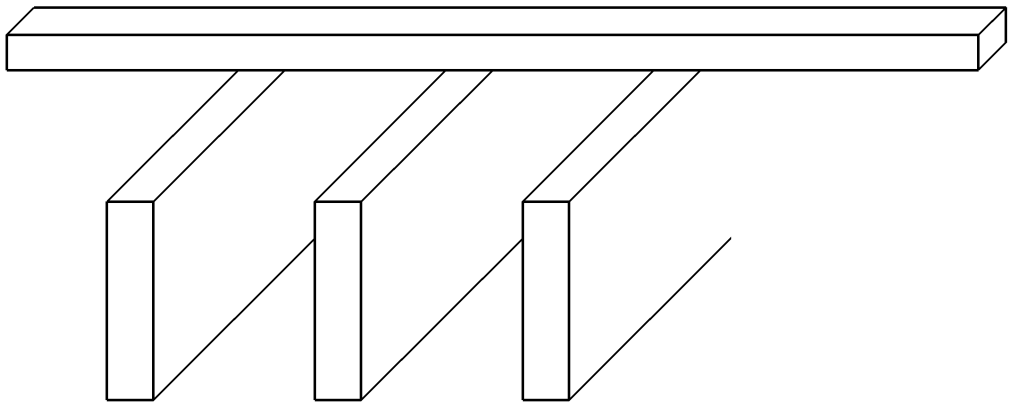


Figure 1 — Example for a baffle (other design systems may exist)

4 Test arrangements

4.1 Test specimens

4.1.1 Plane absorbers

4.1.1.1 Size and mounting details for test specimen, test objects and mounting fixture

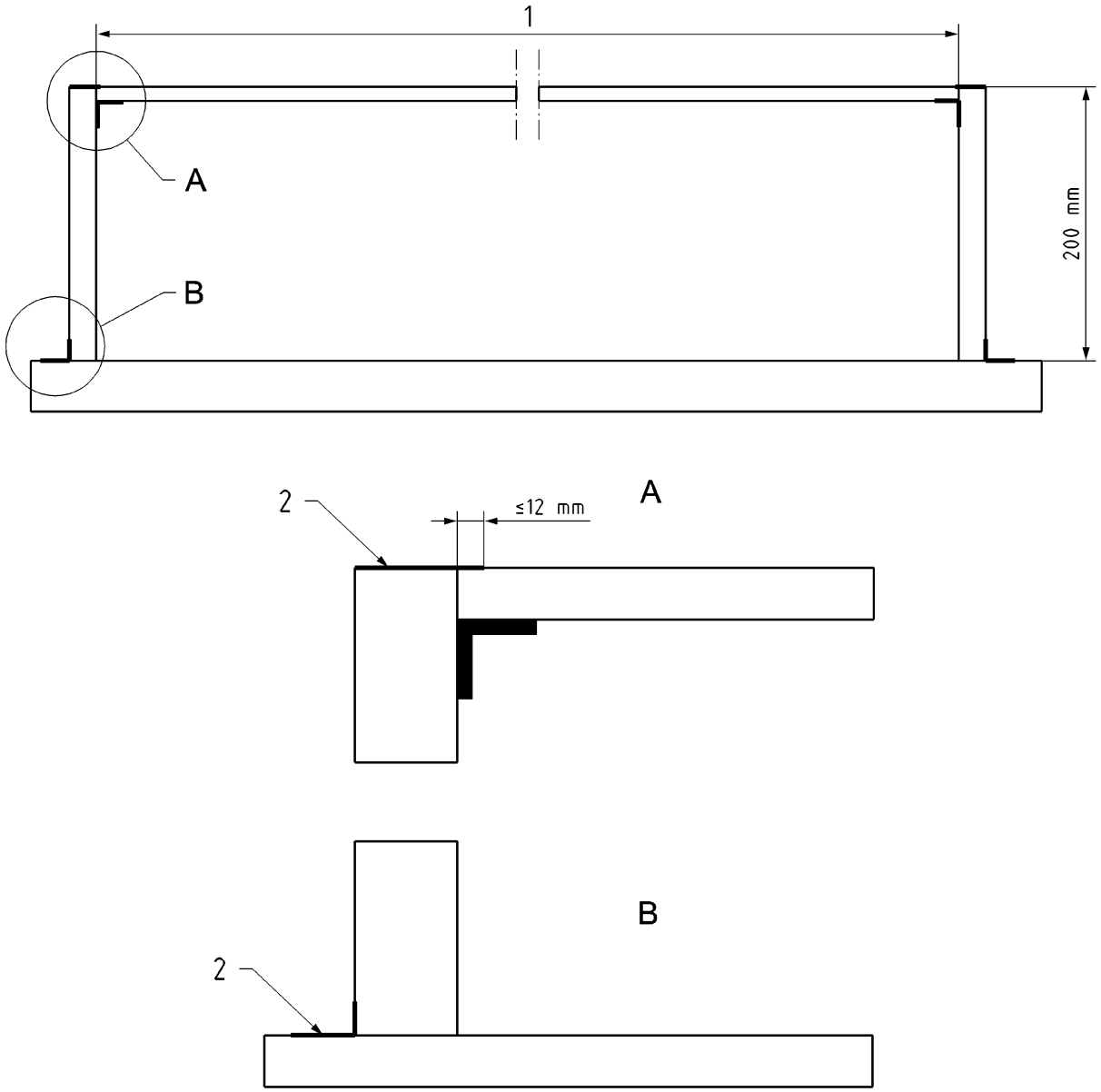
4.1.1.1.1 The test specimen shall have an area as close to 10,80 m^2 as possible. (EN ISO 354:2003, 6.2.1.1)

4.1.1.1.2 The size of the test objects should be 0,6 m × 0,6 m and if not available the closest possible size in the product range.

4.1.1.1.3 Test objects shall be mounted butt together with no seal in the joints. The mounting of the test objects shall be described in the test report.

The area *S* of the test specimen shall be the actual size of the plane consisting of the test objects butt together, Figure 2.

4.1.1.1.4 The exposed side of the suspended ceiling shall be at the same level as the top of the mounting fixture and the joint between the test specimen and the mounting fixture shall be covered by a tape, Figure 2, Detail A, or a flexible sealant.



Key

1 measure for calculation of *S*

2 tape

Figure 2 — Dimension to be used for calculation of specimen area *S*. Detail A showing application of tape over joint

4.1.1.1.5 The edges of the specimen and the mounting fixture shall not be parallel to the nearest edge of the room; an angle of at least 10° should be aimed at. (EN ISO 354:2003, 6.2.1.2)

4.1.1.1.6 Mounting fixture shall be of solid, preferably wooden material, without any cavities and with a surface density of at least 20 kg/m^2. (EN ISO 354:2003, B.4)

NOTE In order to have a mounting fixture, flexible to small variations of the specimen size, the so called “wind mill solution” might be an alternative to a fixed-size mounting fixture, Figure 3.

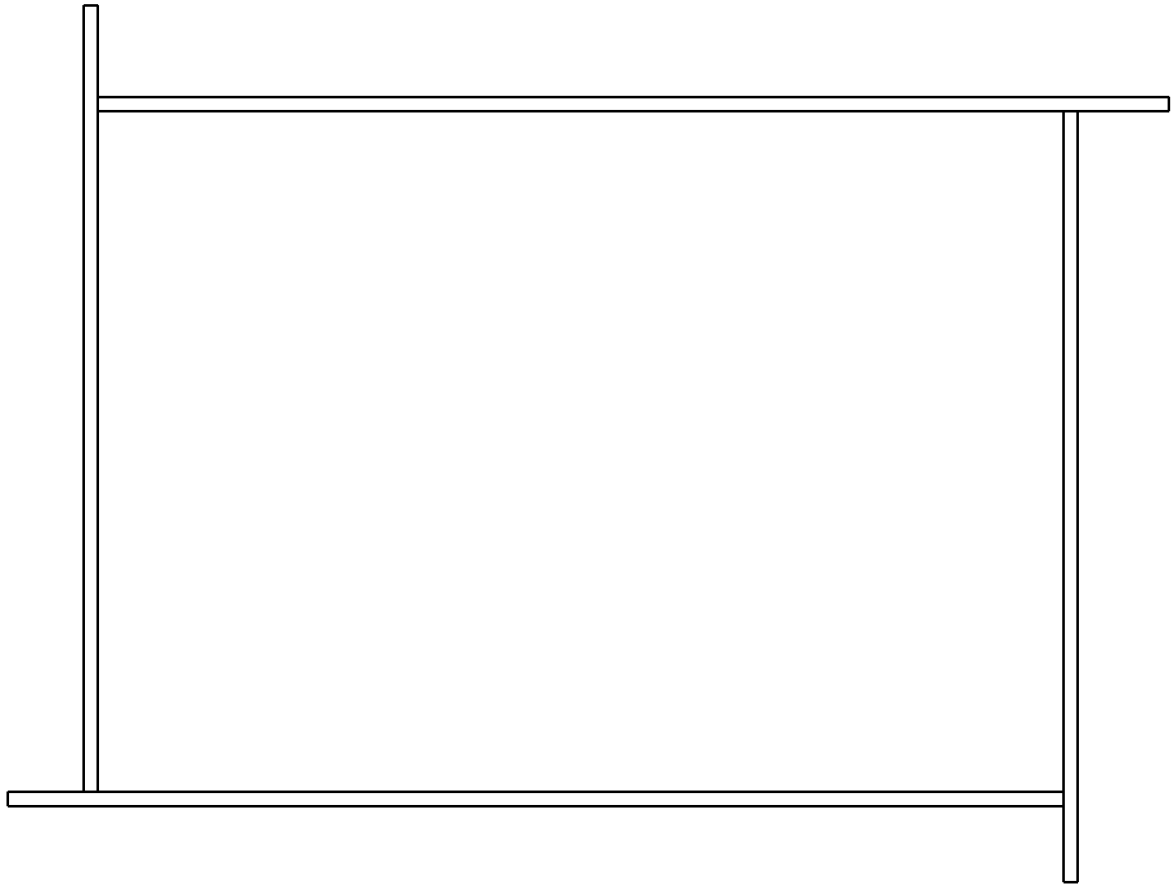


Figure 3 — Mounting fixture of wind mill type

4.1.1.1.7 Open joints within the mounting fixture shall be sealed to prevent air leakage between the enclosed space and the outside. Any open cavity inside the fixture shall also be sealed, to avoid sound absorption in the enclosed space in accordance to EN ISO 354:2003, B.4.

4.1.1.2 Type of plane absorber mounting

4.1.1.2.1 Type A mounting according to EN ISO 354:2003, B.2

4.1.1.2.1.1 This mounting is used for products that are attached directly against a hard surface or substructure by adhesives or mechanical fasteners, which do not leave any thin air space between the product and the surface to which it is attached.

4.1.1.2.1.2 The perimeter edge of the test specimen shall be sealed or covered with the mounting fixture as described in 4.1.1.1 to prevent the edges from absorbing sound. However if the edges of the test specimen are exposed when the products are normally installed in an actual application, then the edges of the test

specimen shall not be sealed or covered by any mounting fixture during a test. If the edges are not sealed or covered, the area of the edges shall be included in calculating the test specimen area.

The treatment of the edges of the test specimen shall be described in the test report. If the area of the specimen edges was included in the calculation of test specimen area, this shall be noted in the test report.

4.1.1.2.2 Type B mounting according to EN ISO 354:2003, B.3

4.1.1.2.2.1 This mounting is used for products that are glued directly to a hard surface with an acoustic panel adhesive, an application which normally leaves a thin airspace between the product and the surface to which it is adhered.

4.1.1.2.2.2 The perimeter edge of the test specimen shall be sealed or covered with the mounting fixture as described in 4.1.1.1 to prevent the edges from absorbing sound. If there are no instructions how thick to apply the dabs of the adhesive, a 3 mm airspace shall be used. In order to secure the air space, shims of 3 mm thickness of size 25 mm by 25 mm shall be located at the 4 corners of each test object.

4.1.1.2.2.3 If a gypsum board is used as the hard surface it shall remain in the reverberation room also during the measurement of the empty room reverberation.

4.1.1.2.3 Type E mounting according to EN ISO 354:2003, B.4

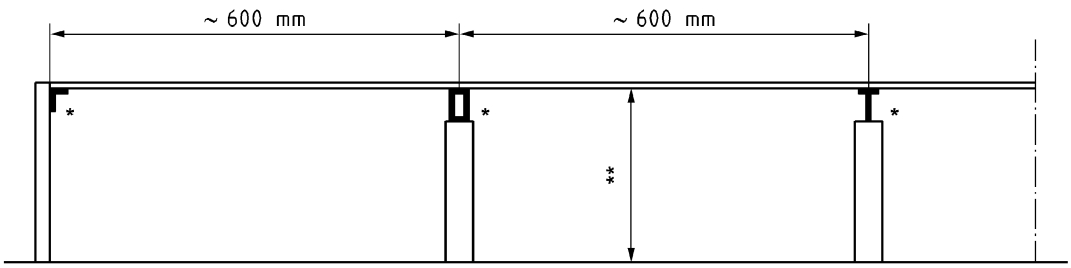
4.1.1.2.3.1 This mounting is used for products that are suspended from a hard surface creating an important air space in between. According to EN ISO 11654, it is recommended to make at least one measurement with an overall depth of construction of 200 mm, which also shall be used for the compilation of data for CE marking, Figure 2.

4.1.1.2.3.2 For the purpose of CE marking it is <u>not</u> allowed to make measurements with the specimen embedded in the floor, having the surface of the specimen at the same level as the floor and the air-space down in the floor.

4.1.1.2.3.3 Grids shall <u>not</u> be used to cover the joints between test objects. Test objects with exposed edges due to absence of grids during measurement, should be avoided, if other edge types are available and have the same acoustic properties.

NOTE If grids for some reason are included in the measurement, the figures received will represent a suspended ceiling kit and not a ceiling membrane according to EN 13964.

4.1.1.2.3.4 Test objects might be supported in one direction by a substructure with a width ≤ 30 mm, a height ≤ 50 mm and a centre distance of approx. 0,6 m, Figure 4.



Key

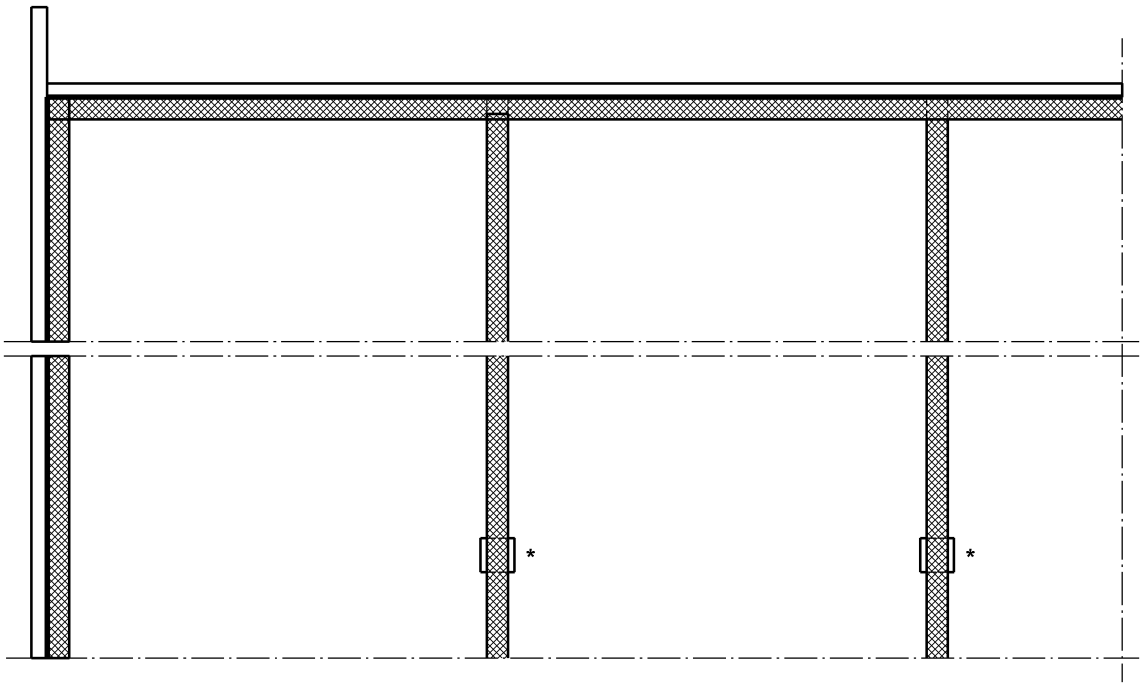
* Substructure profiles of any shape and material with width ≤ 30 mm and height ≤ 50 mm.

** Deflection of the test specimen at any point ≤ 5 mm

Figure 4 — Substructure properties

4.1.1.2.3.5 The deflection of the test specimen shall be ≤ 5 mm, Figure 4.

4.1.1.2.3.6 Each piece of substructure might be supported from the floor by the mounting fixture and by support units of any kind of material at centre distances of ≥ 1,2 m, Figure 5. The cross section of the support units shall be ≤ 50 mm × 50 mm.



Key

* support units of any shape and material with cross section ≤ 50 mm × 50 mm and a centre distance of ≥ 1,2 m.

Figure 5 — Substructure support (view from below)

4.1.1.2.3.7 For measurements of an assembled suspended ceiling system, where the test specimen is composed of e.g. perforated tiles or panels backed by loosely laid porous material with an airspace behind it, the upside-down mounting may affect the sound absorption due to gravity effects. In normal suspended ceiling installations the porous material will be kept tight to the tile or panel due to gravity. If such a ceiling is measured upside-down, loosely laid porous material shall be supported by a metal grid made from wires, with a maximum diameter of 2 mm and with a mesh width of about 100 mm in both directions. The grid shall be so supported and stretched that the porous material is slightly and evenly pressed against the rear of the tile, simulating gravity.

4.1.2 Discrete sound absorbers

NOTE see EN ISO 354:2003, 6.2.2.

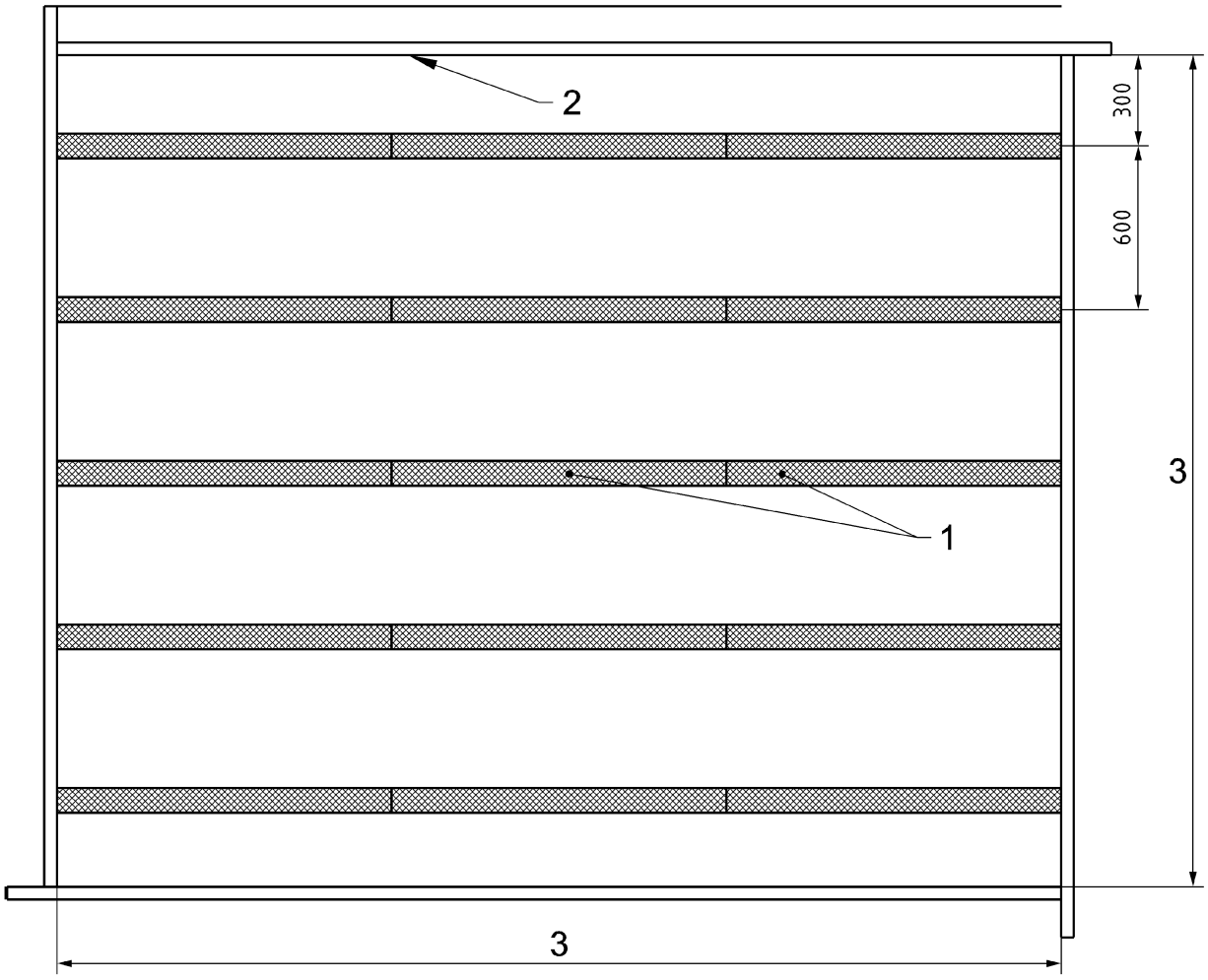
4.1.2.1 Type J mounting according to EN ISO 354:2003, B.7

4.1.2.1.1 This mounting shall be used for the general measurement of the sound absorption coefficient of baffles and for comparison reasons the below details apply.

4.1.2.1.2 The test specimen shall have an area as close to 10,80 m^2 as possible.

4.1.2.1.3 The size of the test objects shall be 1,2 m × 0,6 m and, if not available, closest possible size.

4.1.2.1.4 The baffles shall be arranged in two or more parallel rows, having the same direction as the length direction of the baffles. The rows shall be parallel to the length of the test specimen. The centre distance *d* between rows shall be fixed to 600 mm, Figure 6 and Figure 7.



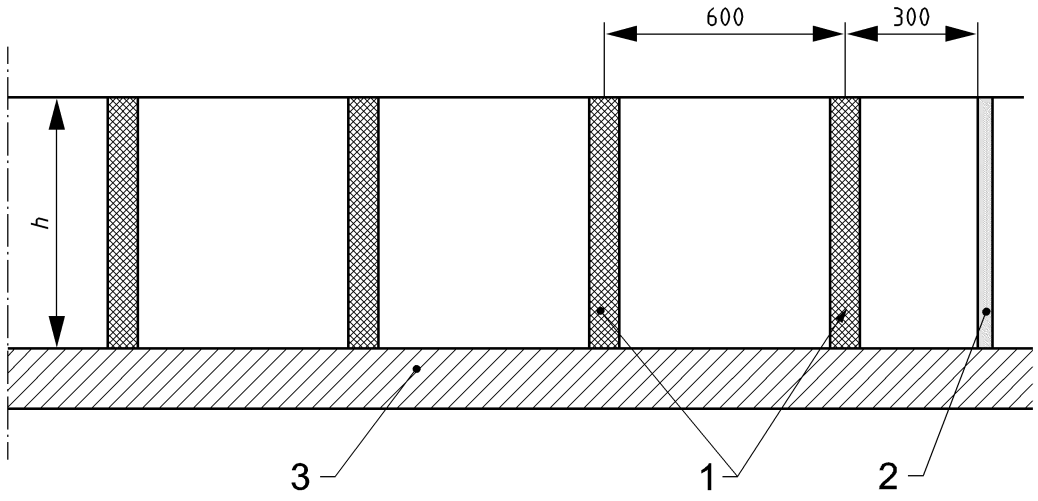
Key

1 baffles

2 barrier

3 measure for calculation *S*

Figure 6 — Example of baffle mounting (top view)



Key

1 baffles

2 barrier

3 measurement room floor

h height of baffles and barrier

Figure 7 — Example of baffle mounting (cross section)

4.1.2.1.5 The baffles shall rest on the floor and there shall be no space between the single baffles in a row.

4.1.2.1.6 The baffles shall be surrounded by a non-absorptive barrier having the same height as the height of the baffles (well approach). No part of the barrier shall be closer than 1 m to any of the walls of the room, which means that no wall shall be a part of the barrier. The barrier shall be made of a non-absorptive material and shall not be parallel to any of the edges of the room; an angle of at least 10° should be aimed at.

4.1.2.1.7 The parts of the barrier parallel to the absorptive area of the baffles shall be *d*/2 from the centreline of the nearest row of baffles. The parts of the barrier perpendicular to the rows of baffles shall be flush with the ends of the baffles.

4.1.2.1.8 The barrier shall not be removed from the room for the empty room measurements

4.2 Temperature and humidity

4.2.1 Choice of test conditions

The test conditions – temperature and relative humidity – during the course of a measurement shall be so chosen, that the numerical value of the correction for the change in air absorption to the sound absorption coefficient does not exceed 0,05 at any frequency. The correction is calculated as $4V(m_2\text{-}m_1)/S$ and derived from EN ISO 354:2003, Formula (8) and EN ISO 354:2003, Formula (9) (see EN ISO 354:2003, 6.3.1).

The use of a humidifier in the test facility may be necessary to fulfil these requirements, but shall be turned off during measurements.

4.2.2 Relative humidity

The relative humidity in the room shall be at least 50 % (see EN ISO 354:2003, 6.3.2).

4.2.3 Check of test conditions

The relative humidity and the temperature have to be checked for each measurement (see EN ISO 354:2003, 6.3.2).

4.3 Rules for sampling

If possible, select test samples from a regular production and avoid samples from pilot production. If possible, use some kind of random selection method. Date and time of sampling, production line or unit, personnel responsible for the sampling and the applied sampling method, if any, should be reported by the client and summarized in the test report.

5 Measurement of reverberation time

5.1 Microphones and microphone positions

Avoid that microphone positions are chosen in a plan parallel to any of the room surfaces.

5.2 Empty room measurement

The empty room reverberation time shall be measured in stable temperature and relative humidity conditions at least once a day preferably in the morning or in the start of a test series. On days, when differences in climatic conditions result in corrections exceeding what is said in 4.2.1 above, a second measurement shall be done by the end of the same day or by the end of a test session the same day. The sound absorption shall then be calculated using this second measurement.

6 Measurement uncertainty

6.1 General

The overall measurement uncertainty of sound absorption coefficients is influenced by various parameters. The most important factor causing uncertainty is described by reproducibility limits. This is caused by the complete measurement set-up including the reverberation room and the mounting method (see EN ISO 354:2003, 8.2). Variations due to laboratory set-up were investigated in a Round Robin Test (RRT) organized by CEN/TC 126/WG 11. For more details about this Round Robin, see Annex A.

6.2 Uncertainty

One of the tasks for the RRT mentioned in 6.1 above was to compile uncertainty figures for the reproducibility between European laboratories measuring sound absorption coefficients.

This RRT shows a clear difference in reproducibility between a product with high sound absorption on one hand and the other two products with lower sound absorption on the other hand. The product with high sound absorption shows a lower reproducibility and to be on the safe side, the calculations of uncertainty of the sound absorption coefficients are therefore performed with this product. This does also mean that products with lower sound absorption most likely will have less uncertainty.

For suspended ceiling plane absorbers with a 200 mm overall depth of construction, type E mounting (4.1.1.2.3), the uncertainty is shown in Table 1. The details of the calculations are given in Annex A.

Table 1 — Sound absorption coefficient uncertainty related to reproducibility

Frequency Hz	Uncertainty
125[a]	±0,23
250	±0,23
500	±0,11
1 000	±0,10
2 000	±0,10
4 000	±0,13
α_w	±0,08[b]

[a] This frequency is not included in the calculation of α_w.

[b] Calculated without any rounding in the calculation chain in EN ISO 11654.

These uncertainty figures are valid only for plane absorbers with type E mounting. No figures have been investigated for other absorbers or mounting types.

NOTE According to ISO 5725-1 a reproducibility limit is defined as “The value, less than or equal to which the absolute difference between two test results obtained under reproducible conditions, may be expected to be with a probability of 9 5 %” In other words: “Test results on identical test material reported by two test laboratories will differ by more than the reproducibility limit on average not more than once in 20 cases in the normal and correct operation of the method”. According to ISO 5725-6 a coverage factor of 2,8 has been applied on the reproducibility standard deviation to calculate the uncertainty.

7 Test report

The test report shall include the following information: (supersedes EN ISO 354:2003, Clause 9)

a) a reference that the test was carried out in accordance with EN ISO 354 and this European Standard;

b) name and address of testing laboratory and responsible person that performed the test;

c) date of test and identification number of test report;

d) dimensions of the reverberation room, its volume, V, and its total surface area (walls, floor and ceiling), S_t;

e) shape of the reverberation room, its diffusion treatment (the number and size of diffusers) and number of microphone and sound source positions;

f) state which evaluation method and which instrumentation was used;

g) name and address of the client;

h) name and address of the manufacturer/supplier/plant;

i) description of the test specimen, area of the test specimen, S, and its mounting and position in the reverberation room by means of drawings and photos. In case of a type J mounting, the height of the baffles and the centre distance d between two rows;

j) identification of test objects;

k) a general description of the test objects, including mass per unit area if requested, thickness and size, together with details of the construction of the test specimen;

l) if available, describe how the test objects have been sampled, which selection method has been used and from what type of production;

m) photo of the whole specimen, of objects and of details;

n) temperature and relative humidity during measurements of T_1 and T_2;

o) any deviations from the test method and the test code;

p) test results, reported in accordance with EN ISO 354:2003, 8.3 and EN ISO 11654.

Annex A
(informative)
Round Robin Test performed for the development of this Test Code standard

As mentioned in the introduction of this Test Code standard one of the tasks for CEN/TC 126/WG 11 was to organize a Round Robin Test (RRT) for sound absorption measurement of suspended ceilings. The aim of this RRT was to elaborate figures for reproducibility of the measurements, but also to take into account new, more detailed instructions.

WG 11 decided to run the RRT with a type E mounting according to EN ISO 354:2003, Annex B.4, with a 200 mm overall depth of construction, which is the common way to compile the sound absorption single value α_w for CE marking. This was accomplished in the spring 2010 by in all 22 laboratories performing the requested mandatory part of this RRT. The measurements included 3 sound absorbing products with very different sound absorption characteristics and material properties. Sets of products were sent to each laboratory and in order to avoid any possible differences between the sets, products originating from the same batch were chosen and a special selection method from the batch was applied.

The mandatory part of the RRT was performed according to EN ISO 354:2003, plus a preliminary version of this Test Code developed by CEN/TC 126/WG 11. This preliminary Test Code included more stringent or additional requirements compared with EN ISO 354:2003, without being in conflict. These requirements concerned the test specimen and mounting fixture and their installation, rules for the amount and placement of microphones and loudspeakers, rules for humidity and temperature, and choice of measurement method.

Preliminary results from the analyses were presented to the participating laboratories and WG 11 in November 2010, followed by additional collection and control of data. Analyses were finished in the beginning of 2011 and a final report was issued in June 2011, document CEN/TC 126/WG 11/N 075. Conclusions from the analyses are that repeatability might be slightly improved and that reproducibility between laboratories seems to be much improved compared with earlier RRTs in the 1980-ies and 1990-ies. But even if the reproducibility is improved, there is still some substantial spread in results between different laboratories.

The results achieved in the RRT are used to calculate the uncertainty figures given in 6.2 of this standard. There was a clear difference in reproducibility between a product with high sound absorption and the other two products with lower sound absorption, showing that the product with high sound absorption has lower reproducibility. This product, being a 50 mm glass wool absorber, was chosen to be on the safe side in the calculation of the uncertainty. For these calculations the reproducibility figures from selected laboratories measuring T_{20} were used, selected are those laboratories complying with EN ISO 354:2003 and the preliminary Test Code.

Those parts of the preliminary Test Code, that were assessed to have an influence on sound absorption coefficients, have been included in this Test Code standard.

On the other hand no connections were found between sound absorption coefficients and the following details:

— The amount of microphones, loudspeakers or decays.

— The use of measurement method; interrupted noise versus impulse noise.

— The shape of the measurement room; rectangular versus not rectangular.

— The use of evaluation range; T_{20} versus T_{30}.

— The volume and the temperature of the measurement room.

It was also concluded that the connections found between sound absorption coefficients and the following details were not strong enough:

— The atmospheric pressure.

— The measurement room volume versus empty room reverberation.

— The surface of diffusers versus the measurement room volume or versus the measurement room surface area.

Another remarkable detail was that many laboratories did not comply with the requirement in EN ISO 354:2003, 6.1.4, concerning the maximum amount of equivalent sound absorption area in the empty measurement room, in all 12 of the participating laboratories failed. The requirement in the same paragraph, that the graph of the equivalent sound absorption area shall be smooth, was not fulfilled by 8 laboratories.

The performed RRT has solely covered suspended ceilings with an overall depth of construction of 200 mm. Product standard EN 13964 does however include other types of ceilings in its definition of suspended ceilings. Solutions like ceilings with a thin airspace between the product and the surface, to which it is adhered, are included and also products that are attached directly against a hard surface or substructure by adhesives or mechanical fasteners, which do not leave any thin air space. Baffles are also included in the EN 13964 definition. However, none of these suspended ceiling types have been evaluated in this RRT.

Bibliography

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-6, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™