BS EN 16703:2015

BSI Standards Publication

# Acoustics — Test code for drywall systems of plasterboard with steel studs — Airborne sound insulation

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**National foreword**

This British Standard is the UK implementation of EN 16703:2015.

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.


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EUROPEAN STANDARD

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EUROPÄISCHE NORM

# EN 16703

September 2015

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English Version

# Acoustics - Test code for drywall systems of plasterboard with steel studs - Airborne sound insulation

Acoustique - Code d'essai pour systèmes de cloisons sèches en plaques de plâtre avec montants en acier - Mesure de l'affaiblissement aérien

Akustik - Prüfvorschrift für Trockenwandsysteme aus Metallständerwänden mit Gipsplattenbeplankung - Messung der Luftschalldämmung

This European Standard was approved by CEN on 8 August 2015.

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

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



Ref. No. EN 16703:2015 E

# Contents

## European foreword

This document (EN 16703:2015) 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.

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of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

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

This standard is a complement to the European Standard EN ISO 10140-1 and is not intended to replace it. The complement includes more stringent rules, narrower tolerances and new, additional requirements.

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 520:2004+A1:2009 “Gypsum plasterboards – Definitions, requirements and test methods” specifies requirements and test methods and establishes how to declare characteristics and to affix the CE marking of products accordingly. In EN 520:2004+A1:2009, when a drywall partition with plasterboard and steel studs has an airborne sound insulation performance property, its sound reduction should be determined in accordance with EN ISO 140-3, now replaced by EN ISO 10140-2. The measured sound reductions are calculated into sound reduction index $R_{,}$ in third octave bands and into single number indexes, in accordance with EN ISO 717-1. Those single number ratings are used for the CE marking.

Measurement of sound reduction according to EN ISO 10140-2 was known through earlier inter laboratory tests (ILT), to generate large spread in results from different laboratories. This was not suitable, 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 9 “Test Code for drywall partition with plasterboard and steel studs”, with the scope to improve reproducibility by developing a Test Code complementary to the EN ISO 10140-1. One part of this work was to organize ILT for sound reduction measurements, to assess the uncertainty of acoustic quantities (Annex D). This was used by the working group to prepare this test code for drywall systems, including guidelines of testing installation and validation of laboratory, to decrease the level of uncertainty.

# 1 Scope

This European Standard specifies information additional to EN ISO 10140-1 necessary to carry out efficiently and under standardized conditions the determination of the sound reduction index of drywall systems of plasterboard with steel studs according to EN ISO 10140-2 "Acoustics — Laboratory measurement of sound insulation of -building elements — Part 2: Measurement of airborne sound insulation". Observe that all demands in EN ISO 10140-2 should still be fulfilled. In order to decrease the uncertainty, it specifies:

— additional guidelines for testing drywall systems of plasterboard with steel studs;

and

— a method to validate laboratory by using two reference test partitions.

The results obtained are used to convert frequency-dependent sound reduction index into single number ratings, according to EN ISO 717-1. These performances can be used to compare different products, or, and to express a requirement, or, and as input into estimation methods, such as EN 12354-1.

# 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 520:2004+A1:2009, *Gypsum plasterboards — Definitions, requirements and test methods*

EN 13162, *Thermal insulation products for buildings — Factory made Mineral wool (MW) products — Specification*

EN 13963, *Jointing materials for gypsum boards — Definitions, requirements and test methods*

EN 14195, *Metal framing components for gypsum board systems — Definitions, requirements and test methods*

EN 14566, *Mechanical fasteners for gypsum plasterboard systems — Definitions, requirements and test methods*

EN ISO 10140 (all parts), *Acoustics — Laboratory measurement of sound insulation of building elements (ISO 10140, all parts)*

# 3 Terms and definitions

For the purposes of this document, the following term and definition apply.

**3.1**
**drywall system of plasterboard with steel studs**
partition comprising a non load bearing metal frame partition enclosed by plasterboards

# 4 Test code for drywall systems of plasterboard with steel studs

## 4.1 Application

**4.1.1** This standard applies to non-load bearing metal frame partition comprising a metal frame enclosed by plasterboards.

In general, the type, size, gauge and spacing of the studs, and the size, type and number of layers of plasterboard and eventual amount and type of cavity filling material in partition constructions are determined by the performance requirements of the system.

**4.1.2** The quantity to be determined is the sound reduction index *R* as a function of frequency. The definition of *R* is given in EN ISO 10140-2.

## 4.2 Testing Guidelines

### 4.2.1 Test element

The partition size shall be between 9 $m^2$ – 12 $m^2$.

For all others information, refer to EN ISO 10140-1 and EN ISO 10140-2.

### 4.2.2 Boundary and mounting conditions

#### 4.2.2.1 General rules

The test element shall be mounted directly on the facilities frame; it shall not be a prefabricated full partition.

The test element should be installed in a similar manner to the actual construction with careful simulation of typical connections and sealing conditions at the perimeter and at all joints.

#### 4.2.2.2 Perimeters mounting

A gap of about 5 mm to 10 mm shall remain between the plasterboards and the reveal of the test opening. This gap shall be filled with appropriate material. Drying time has to respect product instruction according to 4.3.1 because the type of filler will have an influence on the performance of the partition.

Cracks in the perimeter may occur, resulting in air leakage. To control risk a procedure shall be set in the laboratory to check this. This shall be at minimum a visual control but can also be any additional method.

#### 4.2.2.3 Partition positions

The sound reduction index of drywall system of plasterboard with steel studs is influenced by the mounting conditions in the test opening of the laboratory. Important installation parameters include the niche depth and the position of the partition in relation to the acoustic break in the test aperture.

The partition shall be installed into the test opening so that the niches on both sides of the partition have different depths with a ratio of 2:1.

To improve the reproducibility between laboratories and facilitate comparison of sound reduction indices for different drywall system of plasterboard with steel studs, the partition (even double wall) shall not be mounted across the acoustic break between sending and receiving room of the laboratory, but on the same side of the break as indicated in Annex A.

Main mounting conditions are reported in Annex A; others may be used but shall be fully described in the test report.

NOTE Mounting the lightweight partition with one leaf on one side and the other leaf on the other side of the acoustic break can result in higher values for the sound reduction index.

Other mounting conditions may be suitable for certain types of twin leaf walls, for example, walls for semidetached houses where the leaves are vibrationally uncoupled (for example on separate foundations). In such cases the wall leaves can be mounted on each side of the acoustic break.

No absorption material should be located close (less than 1 m) to the perimeter of the partition. The acoustic break has to be covered with soft reflecting materials.

#### 4.2.3 Test report

The test report shall include the information listed in EN ISO 10140-2:2010, Clause 9 and the following additional information shall also be reported:

a) detailed description of the perimeters treatments;

b) detailed description of the putty used and its drying time;

c) detailed description of the fasteners used (screws spacing, stud centre) including perimeter frame;

d) detailed description of the partition position ; it is recommended to refer to Annex A.

### 4.3 Validation of the laboratory with two reference test partitions

#### 4.3.1 Test elements

To reduce expanded uncertainty in a reproducibility condition of drywall plasterboard partition with steel stud, it is required to conduct preliminary tests with two laboratory reference test partitions described in Annexes B and C.

The materials used to conduct these reference test partition tests should be products in accordance with the properties reported in Tables B.1 and C.1.

The properties of the products mentioned shall be measured using the methods within the relevant product standard except for the E-modulus properties.

The position of the reference test partitions shall be in accordance with Annex A.

The installation of the reference test partitions shall be in accordance with the Annex B (partition type 1) and Annex C (partition type 2). The measurement shall be done at least 12 h after installation in accordance with EN ISO 10140-2.

#### 4.3.2 Acceptance criteria

##### 4.3.2.1 General

Tables 1 and 2 define the envelope of partition type 1 and type 2 respectively.

The acceptance criteria is met if the measured spectra for both reference test partitions are within the envelopes presented below or the sum over all third octave bands of the deviations between the measured and the envelope values does not exceed 4 dB (see 4.4 for further information on uncertainty values and how to apply).

The deviation of 4 dB has been decided to take into account modal behaviours in low frequency and where critical frequency has influenced the sound reduction. This has been observed to be influenced by both laboratory configuration origin and plasterboard stiffness. If the local minimum around the critical frequency is not in the 3150 Hz third octave band, it is recommended to control the value of the E modulus of the plasterboard to be close to the ones that have been tested initially for the laboratory

qualification (± 20 % of the properties mentioned in Table D.1). The E-modulus could be measured indifferently with one of the two methods proposed in Annexes E and F.

#### 4.3.2.2 Envelope for partition type 1

**Table 1 — Min and Max values of the sound reduction index *R* of the reference test partition type 1**

| **frequency** (Hz) | $R_{min}$ (dB) | $R_{max}$. (dB) |
|---|---|---|
| 50 | 10,3 | 21,5 |
| 63 | 8,9 | 19,5 |
| 80 | 8,1 | 17,0 |
| 100 | 12,3 | 16,8 |
| 125 | 20,1 | 25,0 |
| 160 | 27,9 | 32,2 |
| 200 | 32,2 | 35,2 |
| 250 | 34,0 | 38,6 |
| 315 | 38,3 | 42,2 |
| 400 | 42,2 | 46,0 |
| 500 | 44,9 | 49,9 |
| 630 | 47,2 | 52,2 |
| 800 | 49,6 | 55,8 |
| 1 000 | 50,9 | 60,2 |
| 1 250 | 51,5 | 63,0 |
| 1 600 | 52,3 | 63,6 |
| 2 000 | 51,2 | 60,9 |
| 2 500 | 42,2 | 48,7 |
| 3 150 | 39,9 | 44,8 |
| 4 000 | 44,1 | 48,8 |
| 5 000 | 47,4 | 52,4 |

#### 4.3.2.3 Envelope for partition type 2

**Table 2 — Min and Max values of the sound reduction index *R* of the reference test partition 2**

| **Frequency** (Hz) | $R_{min}$ (dB) | $R_{max}$. (dB) |
|---|---|---|
| 50 | 19,2 | 26,4 |
| 63 | 21,8 | 30,6 |
| 80 | 30,9 | 35,5 |
| 100 | 37,0 | 41,4 |
| 125 | 41,0 | 45,0 |
| 160 | 44,3 | 50,3 |
| 200 | 49,2 | 53,8 |
| 250 | 52,8 | 57,6 |
| 315 | 55,1 | 60,6 |
| 400 | 59,0 | 65,0 |
| 500 | 61,3 | 68,6 |
| 630 | 62,8 | 70,3 |
| 800 | 64,6 | 71,9 |
| 1 000 | 66,2 | 75,3 |
| 1 250 | 67,9 | 77,8 |
| 1 600 | 69,2 | 79,7 |
| 2 000 | 68,8 | 79,0 |
| 2 500 | 60,4 | 72,1 |
| 3 150 | 60,1 | 71,8 |
| 4 000 | 62,0 | 74,6 |
| 5 000 | 62,8 | 75,5 |

### 4.3.3 Remedial investigation

If the measurement results do not meet the given criteria then the analysis of the interlaboratory test organized in 2010 (Annex D) suggests that the following reasons should be investigated:

— diffusivity (please refer to the EN ISO 10140-5:2010, 3.2.2);

— flanking transmission, in particular for partition type 2 (please refer to the EN ISO 10140-5:2010, 3.2.5).

NOTE Other parameters like changing loudspeaker and microphone positions can be a way to reach the criteria.

These remedial actions should be applicable for both reference test partitions and shall be applied for all further testing.

## 4.4 Application of uncertainties

If the testing guidelines are applied, the laboratory is validated as above and the acceptance criteria for the two reference test partitions are met then the standard uncertainties values given in the table below can be applied.

**Table 3 — Standard uncertainties *u* of single number quantities**

| **Single number** | **Standard uncertainty in a reproducibility condition *u* (dB)** |
|---|---|
| $R_w$ | 0,7 |
| $R_w$+C | 0,7 |
| $R_w$+C $_{tr}$ | 1,1 |

For measurement results obtained in accordance with the EN ISO 10140 (all parts), the expanded uncertainty *U* shall be calculated by:

$$U = k\,u \qquad [1]$$

where

*U* is the expanded uncertainty calculated for a given confidence level for the two-sided test 95 %;

*u* is the standard uncertainty determined in Table 3 of this standard; and

*k* is the coverage factor. Its value depends on the distribution of the possible values of the measure and on the confidence level.

For the purpose of this standard it is assumed that the values of the $k = 2$.

A measurement result shall then be stated as follows:

$$Y = y \pm U \qquad [2]$$

where

*Y* is the measurand (Rw, Rw+C, Rw+Ctr);

*y* the best estimate found by the measurement;

*U* is the expanded uncertainty calculated for a given confidence level for the two-sided test 95 %.

For more information about handling uncertainty refer to ISO 12999-1.

# Annex A
(normative)

# Reference test partition location in aperture

## A.1 General

This annex has two objectives:

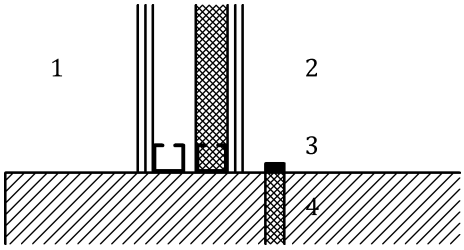
— to define with precision the location of the partition when validating the laboratory with the two reference test partitions;

— to simplify the description of the partition's location in test report.

To ensure a good reproducibility the specimen has to be installed on source side, and its location has to be reported with the letters representing the following privileged configuration.

## A.2 Case A “Aperture without niche and one acoustic break”

Case A is the configuration with an aperture without a niche and with one acoustic break; see Figure A.1.




**Key**

1 source room

2 receiving room

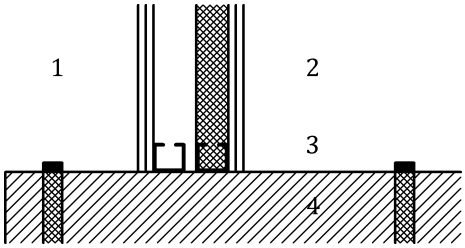
3 acoustic break airtight layer materials

4 acoustic break of the laboratory

**Figure A.1 — Sketch of specimen location case A**

## A.3 Case B "Aperture without niche and two acoustic breaks with Ratio 2:1"

Case B is the configuration with an aperture without a niche and with two acoustic breaks; see Figure A.2.




**Key**

1 source room

2 receiving room

3 acoustic break airtight layer materials

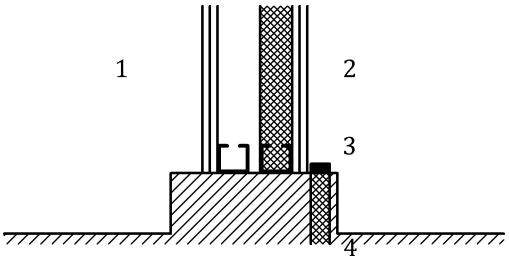
4 acoustic break of the laboratory

**Figure A.2 — Sketch of specimen location case B**

## A.4 Case C "Aperture with niche and one acoustic break"

Case C is the configuration with an aperture with a niche and with one acoustic break; see Figure A.3.

In case where the application of the rules 2:1 makes the partition locate on the acoustic break, then move the partition to the source side of the break.




**Key**

1 source room

2 receiving room

3 acoustic break airtight layer materials

4 acoustic break of the laboratory

**Figure A.3 — Sketch of specimen location case C**

# Annex B
(normative)

# Reference test partition Type 1

## B.1 Description of Reference test partition Type 1

### B.1.1 Single Framework, single board layer partition

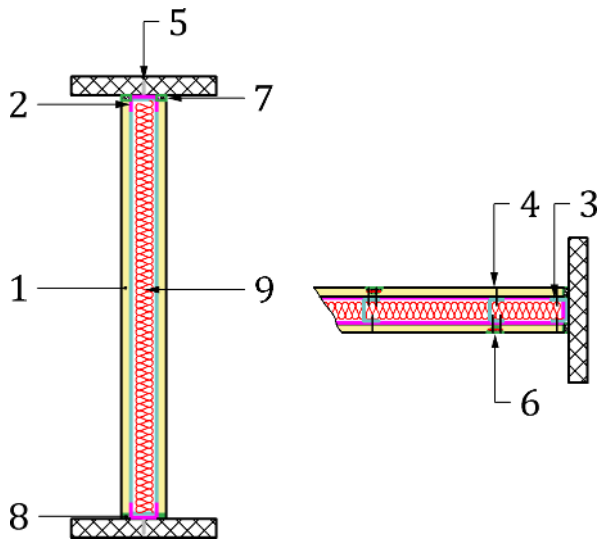
The partition consists of a 70 mm metal stud single framework with studs at 600 mm centres, 70 mm insulation in the cavity and a single layer of 12,5 mm plasterboard on each side of the framework, see Figure B.1. When acquiring the reference test partition materials, the laboratory selects materials respecting the reference properties presented in Table B.1.

If difficulty occurs it is suggested to refer to the local technical assistance of the manufacturer.

**Table B.1 — Material list and essential properties**

| Product | Dimensions | Product standard | Essential properties | |
|---|---|---|---|---|
| Plasterboard with tapered edge | 3000 mm × 1200 mm × 12,5 mm | EN 520:2004+A1:2009 | Surface mass | 8,9 kg/m² to 9,4 kg/m² |
| U-70–30/6 Channel | 30 mm x70 mm × 30 mm | EN 14195 | Steel gauge | 0,54 mm to 0,59 mm |
| C-70–35/6 Studs | 34 mm × 69 mm × 36 mm | EN 14195 | Steel gauge | 0,54 mm to 0,59 mm |
| Screw | 3,5 mm × 25 mm | EN 14566 | / | / |
| Screw | Diameter 6 mm | | / | / |
| Self-adhesive fibreglass tape or glassfibre tape | 52 mm | | / | / |
| Jointing powder (setting compound) | bag | EN 13963 | / | / |
| Acrylic sealant | | | / | / |
| Glasswool 70 mm | 600 mm × 70 mm | EN 13162 | Air flow resistivity | 5 kPa.s/m² to 10 kPa.s/m² |

NOTE The surface mass is determined by measuring the density in compliance with EN 520:2004+A1:2009, 5.11.




**Key**

1 plasterboard with tapered edge
2 U-70–30/6 Channel
3 C-70–35/6 Studs
4 screw
5 screw
6 self-adhesive fibreglass tape
7 jointing powder
8 acrylic sealant
9 glasswool 70 mm

**Figure B.1 — Sketch of the reference test partition 1**

## B.2 Installation procedure of partition Type 1

### B.2.1 Installation of framework with channels and studs

The framework consists of horizontal channels and vertical studs. 70 mm channels are fixed to the bottom and top of the aperture using screws and plastic plugs at nominal 500 mm centres, along the centre of the channel. The first and last fixing shall be located 100 mm from the corner. Please note that no material (foam strip, sealant etc.) shall be applied in between the channel web and the aperture. Channel joints shall be done as a butt joint i.e. the channels are put end to end (no overlap). There shall be a fixing at 100 mm from the joint, on both sides of the joint. Cut the studs so the length is 10 mm shorter than the height of the partition. Fix the first and last stud to the concrete frame of the aperture. The fixings of these studs are done in the same manner as for the channel i.e. using screws and plastic plugs at nominal 500 mm centres along the centre of the stud. The first and last fixing shall be located 100 mm from the corner. Please note that no material (foam strip, sealant etc.) shall be applied in between the stud web and the aperture. Place the remaining studs between top and bottom channel at 600 mm centres. In the starting side turn all the studs so that they have the web in the same direction as the first stud (excepted last stud that is in the opposite direction). The studs shall not be fixed to the top and bottom channels. The distance from the aperture to the first stud installed shall be 600 mm. To facilitate the installation of plasterboards, mark the position of the centre of the studs on the bottom and the top of the aperture.

### B.2.2 Installation of plasterboards 1st side

The plasterboards shall be cut so that there will be a 5 mm clearance on the lateral and top edges of the partition and a 5 mm to 10 mm clearance at the bottom. Cut vertical edges of plasterboards are only allowed on the first and last stud that is fixed to the aperture edges. All other vertical plasterboards edges shall be tapered edges. The plasterboards shall be butt-jointed i.e. without any gap between the tapered edges of the boards. Mark the positions of the screws on the board following the description below. When fully screwed the boards shall be screw fixed as follows: the screws along the edges of the board shall be 10 mm from the edge of the plasterboard. The boards shall be screw fixed into the edge studs and intermediate stud at 300 mm centres. The top and the bottom screw shall be located 100 mm from the top and the bottom end of the board. The board shall be fixed to the channel at top and bottom with one screw located half way between the studs and 15 mm from the board end. Before screw fixing the plasterboard make sure your screw driver is set so that the screw depth will be correct i.e. the screw head shall be flush with the plasterboard. The boards shall be fixed using 25 mm screws. If by mistake a screw is not catching the metal, the screw shall be removed and the hole later filled with jointing material. For the installation of plasterboards cut 5 mm off the left hand edge of the first board (so that there will be a 5 mm clearance to the aperture on the left hand side of the board and the right hand tapered edge of the board will be positioned at the middle of the flange of the third stud). Stand the plasterboard during the installation on a 5 mm to 10 mm spacer to ensure the clearance of the bottom. To ensure the verticality of the studs, only fix the board to the edge studs on the first side of the partition. Fixing to the intermediate stud is done after board have been fixed at the second side of the partition. Install the remaining boards on the first side in the same way.

### B.2.3 Installation of insulation in cavity

Install the 70 mm thick mineral wool inside the cavity between the studs. The mineral wool shall be installed after the plasterboards have been installed on first side of the partition. Cut the mineral wool in lengths that are identically to the height of the partition (in one or more pieces). Ensure that the mineral wool is filled into the studs and the channels.

### B.2.4 Installation of plasterboards 2nd side

After the mineral wool has been installed, the plasterboards on the second side shall be installed so that the joint will be staggered in between the two sides of the partition. Cut the first plasterboard to size, 595 mm wide (so that there will be a 5 mm clearance to the aperture on the right hand side of the board and the left hand tapered edge of the board will be positioned at the middle of the flange of the second stud). Stand the plasterboard on a 5 mm to 10 mm block to ensure the clearance of the bottom. Screw plasterboards first to the studs along the edge of the plasterboard to ensure the verticality of the studs and then fix the plasterboard to the intermediate stud (using the mark on the aperture). There will be no intermediate stud on first half board. Use the same screw centre as described above. Once the plasterboards on the second side have been fully fixed go back to the first side and fix the plasterboards to the intermediate stud.

### B.2.5 Jointing for both sides of the partition

Before applying the compound, ensure that all the screws are in place. Apply the self-adhesive mesh tape over the joint between the boards. Mix a batch of the jointing compound. Follow the product recommendation to prepare the jointing compound. To ensure a good seal, a batch of compound shall be applied within half an hour after mixing. If more than half an hour has passed since mixing, do not use the remaining part of the batch. Throw it away and prepare another batch if needed. Apply one coat of jointing compound on the taper joints and mesh tape. Make sure that compound is pushed through the mesh well into any gap between the boards. Put one coat of jointing material over the screw heads at board centre and board end. Also fill any empty screw holes (screws that didn’t catch the metal properly).

Fill the gap between the aperture and the lateral sides and the top of the partition with jointing compound. Make sure the gap is properly filled. Fill the gap between the aperture and the bottom of the partition with acrylic sealant.

# Annex C
(normative)

# Reference test partition Type 2

## C.1 Twin framework, double board layer partition

### C.1.1 General

The partition consists of two rows of 70 mm metal stud double framework with studs at 600 mm centres and two 70 mm insulation in the cavity and a double layer of 12,5 mm plasterboard on each side of the frameworks; see Figure C.1.

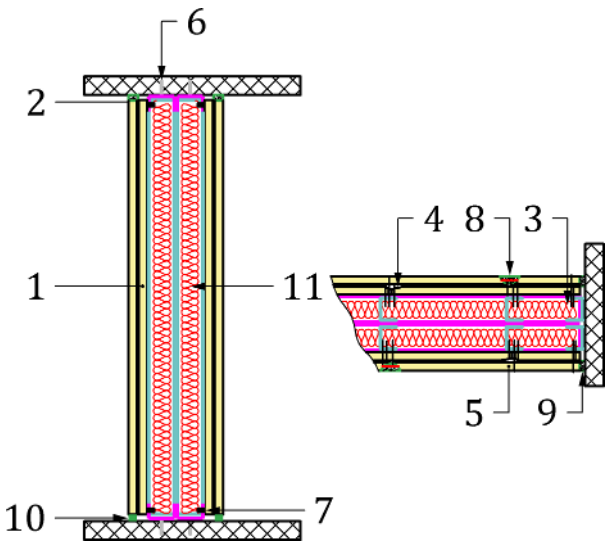
When acquiring the reference test partition materials, the laboratory selects materials respecting the reference properties presented in Table C.1.

If difficulty occurs it is suggested to refer to the local technical assistance of the manufacturer.

**Table C.1 — Material list and essential properties**

| Product | Dimensions | Product standard | Essential properties | |
|---|---|---|---|---|
| Plasterboard with tapered edge | 3000 mm x 1200 mm x 12,5 mm | EN 520:2004+A1:2009 | Surface mass | 8,9 kg/m² to 9,4 kg/m² |
| U-70–30/6 Channel | 30 mm x 70 mm × 30 mm | EN 14195 | Steel gauge | 0,54 mm to 0,59 mm |
| C-70–35/6 Studs | 34 mm × 69 mm × 36 mm | EN 14195 | Steel gauge | 0,54 mm to 0,59 mm |
| Screw | 3,5 mm × 25 mm | EN 14566 | / | / |
| Screw | 3,5 mm × 45 mm | EN 14566 | / | / |
| Screw | Diameter 6 mm | | / | / |
| Wafer head | 4,2 mm × 13 mm | EN 14566 | / | / |
| Self-adhesive fibreglass tape or glassfibre tape | 52 mm | | / | / |
| Jointing powder (setting compound) | bag | EN 13963 | / | / |
| Acrylic sealant | | | / | / |
| Glasswool 70 mm | 600 mm × 70 mm | EN 13162 | Air flow resistivity | 5 kPa.s/m² to 10 kPa.s/m² |
| Channel fixing strip | 70 mm × 3 mm | | | |

NOTE The surface mass is determined by measuring the density in compliance with the EN 520:2004+A1:2009, 5.11




**Key**

1 plasterboard with tapered edge
2 U-70–30/6 Channel
3 C-70–35/6 Studs
4 screw
5 screw
6 screw
7 wafer head
8 self-adhesive fibreglass tape
9 jointing powder
10 acrylic sealant
11 glasswool 70 mm

**Figure C.1 — Sketch of reference test partition 2**

### C.1.2 Installation of framework with channels and studs

The framework consists of a twin framework horizontal channels and vertical studs.

Two 70 mm channels are fixed 25 mm apart to the bottom and top of the aperture using screws and plugs at nominal 500 mm centres, along the centre of each channel. The first and last fixing should be located 100 mm from the corner.

Please note that no material (foam strip, sealant etc.) shall be applied in between the channel web and the aperture.

When the channels are shorter of the length of the aperture then a joint needs to be done. This joint shall be done as a butt joint i.e. the channels are put end to end (no overlap). There shall be a fixing at 100 mm from the joint, on both sides of the joint.

Cut the studs so the length is 10 mm shorter than the height of the partition.

Fix the first and last studs of each framework to the lateral sides of the aperture. The fixings of these four studs are done in the same manner as for the channel i.e. using screws and plugs at nominal 500 mm centres, along the centre of the stud. The first and last fixing shall be located 100 mm from the corner. Please note that no material (foam strip, sealant etc.) shall be applied in between the stud web and the aperture.

Place the remaining studs between top and bottom channel at 600 mm centres. In the starting side turn all the studs so that they have the web in the same direction as the first stud (excepted last stud that is in the opposite direction).

The distance from the aperture to centre of the flange of the second stud in each framework shall be 600 mm.

Fix the studs to the top and bottom channels using a wafer head screw. This fixing shall be on the sides of framework that will take the boarding.

To facilitate the installation of plasterboards mark the position of the centre of the studs on the bottom and the top of the aperture.

## C.2 Installation of plasterboards

### C.2.1 General

The plasterboards shall be cut so that there will be a 5 mm clearance on the lateral and top edges of the partition and a 5 mm to 10 mm clearance at the bottom. Cut vertical edges of plasterboards are only allowed on the first and last stud that is fixed to the aperture edges. All other vertical plasterboards edges shall be tapered edges. The plasterboards shall be butt-jointed i.e. without any gap between the tapered edges of the boards. Mark the positions of the screws on the boards following the description below. When fully screwed the inner (1st) board layer shall be screw fixed as follows: The screws along the edges of the board shall be 10 mm from the edge of the plasterboard. The boards shall be screw fixed into the edge studs and intermediate stud at 600 mm centres. The top and the bottom screw shall be located 150 mm from the top and the bottom end of the board. The inner layer board shall not be fixed to the channel. When fully screwed the outer (2nd) board layer shall be screw fixed as follows. The screws along the edges of the board shall be 10 mm from the edge of the plasterboard. The boards shall be screw fixed into the edge studs and intermediate stud at 300 mm centres. The top and the bottom screw shall be located 100 mm from the top and the bottom end of the board. The board shall be fixed to the channel at top and bottom with one screw located half way between the studs and 15 mm from the board end. The inner (1st) layer boards shall be fixed using 25 mm screws. The outer (2nd) layer boards shall be fixed using 45 mm screws. Before screw fixing the plasterboard make sure your screw driver is set so that the screw depth will be correct i.e. the screw head shall be flush with the plasterboard. If, by mistake, a screw is not catching the metal, the screw shall be removed. If the hole left after the screw is in the outer layer of board, it shall later be filled with jointing material.

### C.2.2 Plasterboard inner layer on first side

Cut 5 mm off the left hand edge of the first board (so that there will be a 5 mm clearance to the aperture on the left hand side of the board and the right hand tapered edge of the board will be positioned at the middle of the flange of the third stud). Stand the plasterboard on a 5 mm to 10 mm block to ensure the clearance of the bottom. Fix the boards using 25 mm screws and screw distances as described above for inner (1st) layer boards. Install the remaining inner layer boards on the first side.

### C.2.3 Plasterboard outer layer on first side

The outer board layer joints shall be staggered in relation to the inner board layer joints. Cut the first plasterboard to size, 595 mm wide, so that there will be a 5 mm clearance to the aperture on the left hand side of the board and the right hand tapered edge of the board will be positioned at the middle of

the flange of the second stud (which is hidden behind the inner layer board centre). Fix the boards using 45 mm screws and screw distances as described above for outer (2nd) layer boards. Install the remaining outer layer boards on the first side.

## C.3 Installation of insulation in cavity

Install the two layers of 70 mm thick mineral wool inside the cavity. The mineral wool shall be installed after the plasterboards have been installed on the first side of the partition. Cut the mineral wool in lengths that are identically to the height of the partition (in one or more pieces). Ensure that the mineral wool is filled into the studs and the channels.

## C.4 Installation of plasterboards 2nd side - Plasterboard inner layer on second side

The plasterboards in the inner layer on the second side shall be installed so that the joint will be staggered in relation to the inner layer on the first side. Cut the first plasterboard to size, 595 mm wide (so that there will be a 5 mm clearance to the aperture on the right hand side of the board and the left hand tapered edge of the board will be positioned at the middle of the flange of the second stud). Stand the plasterboard on a 5 mm to 10 mm block to ensure the clearance at the bottom. Fix the boards using 25 mm screws and screw distances as described above for inner (1st) layer boards. Install the remaining inner layer boards on the second side.

## C.5 Plasterboard outer layer on second side

Cut 5 mm off the right hand edge of the first board (so that there will be a 5 mm clearance to the aperture on the right hand side of the board and the left hand tapered edge of the board will be positioned at the middle of the flange of the third stud). Stand the plasterboard on a 5 mm to 10 mm block to ensure the clearance of the bottom. Fix the boards using 45 mm screws and screw distances as described above for outer (2nd) layer boards.

## C.6 Jointing for both sides of the partition

Before applying the compound ensure that all the screws are in place. Apply the self-adhesive mesh tape over the joint between the outer boards. Mix a batch of the jointing compound. Follow the product recommendation to prepare the jointing compound. To ensure a good seal, a batch of compound shall be applied within half an hour of mixing. If more than half an hour has passed since mixing, do not use the remaining part of the batch. Throw it away and prepare another batch if needed. Apply one coat of jointing compound on the taper joints and mesh tape. Make sure that compound is pushed through the mesh well into any gap between the boards. Put one coat of jointing material over screw heads at board centre and board end. Also fill any empty screw holes (screws that didn't catch the metal properly).

Fill the gap between the aperture and the lateral sides and the top of the partition with jointing compound. Make sure the gap is properly filled. Fill the gap between the aperture and the bottom of the partition with acrylic sealant.

# Annex D
(informative)

# Interlaboratory Tests performed for the development of this Test Code standard

In 2010, an interlaboratory test (ILT) dealing with an inter comparison of laboratory measurements of partition airborne sound insulation according to EN ISO 140-1 and EN ISO 140-3 was conducted. Nineteen laboratories participated to the ILT with 9 European countries. The aim was to develop an acoustic test code for plasterboard drywall systems and steel studs.

Test plasterboards were distributed to the participating laboratories. Two partitions were proposed:

- Partition 1 that is constructed from a twin framework (two parallel frameworks) of 70 mm metal cannels and studs 25 mm apart. The 165 mm wide cavity is filled with 2 layers of lightweight glass wool. Two layers of 12,5 mm plasterboards are screw fixed to both sides of the framework. The total width of the partition is 215 mm. See Figure D.1;

- And partition 2 that is constructed from a single framework of 70 mm metal cannels and studs. The cavity is filled with a single layer of lightweight glass wool. One layer of 12,5 mm plasterboards is screw fixed to both sides of the framework. The total width of the partition is 95 mm. See Figure D.2.

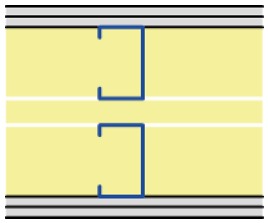


**Figure D.1 — Partition 1**

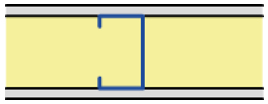


**Figure D.2 — Partition 2**

The laboratory installed the partitions according to Annex B and Annex C of the present document.

**Table D.1 — Mechanical properties of the gypsum board used**

| | Gypsum board | Method |
|---|---|---|
| Thickness h (mm) | 12,5 | EN 520 |
| Density ρ ($kg.m^{-3}$) | 734 | EN 520 |
| Young modulus E (Pa) | 3 GPa | Control method (see informative Annex E) EN 520 and DIN 18180 |
| | 2,8 GPa | Expertise method (see informative Annex F) ISO 16940 adapted to plasterboard [14] |

The main results of this work are presented in the bibliography publication. Refer to the bibliography publication: “European Round Robin Test for sound insulation Measurements of lightweight partition“, Cyrille Demanet, Maria Jose De Rozas, Jean Baptiste Chene, Remy Foret, Internoise – Osaka (2011).

# Annex E
(informative)

# E Modulus - Control Method (static E Modulus with 3 bending points)

The test shall be the same as the one used for flexural breaking load described in 5.7 of EN 520:2004+A1:2009.

To determine the E Modulus, the deflection and the force shall be recorded and post treated.

The E Modulus is calculated in the linear part of the curve that should be taken between 10 % and 40 % of the maximum of flexure breaking load force as described in EN 520:2004+A1:2009.

The E modulus is calculated thanks to the formula below:

$$E = \frac{l_2^3 (F_2 - F_1)}{4bt^3 (a_2 - a_1)} \qquad [E.1]$$

where

$l_2$ is the length in mm of the sample (400 mm following EN 520:2004+A1:2009 requirement);

$b$ is the width in mm of the sample (300 mm following EN 520:2004+A1:2009 requirement);

$t$ is the thickness in mm of the plasterboard;

$F_2 - F_1$ is the difference between the recorded forces $F_1$ and $F_2$ that shall be taken respectively at 10 % and 40 % of the maximum breaking load force;

$a_2 - a_1$ is the difference of the recorded displacement in mm for the forces $F_2$, $F_1$ respectively.

The E-Modulus expressed in GPa has to be rounded at 1 decimal.

# Annex F
(informative)

# E Modulus - Expertise Method (dynamic E Modulus)

This measurement method of the dynamic Young modulus of the referent plasterboard of 12,5 mm is an adaptation of the ISO 16940.

The first point to assess is the dimension, the number and the sampling of the beams on the plaster board. Four samples of dimension (60 ± 2) mm x (600 ± 2) mm are needed, taken in the board as shown in Figure F.1.

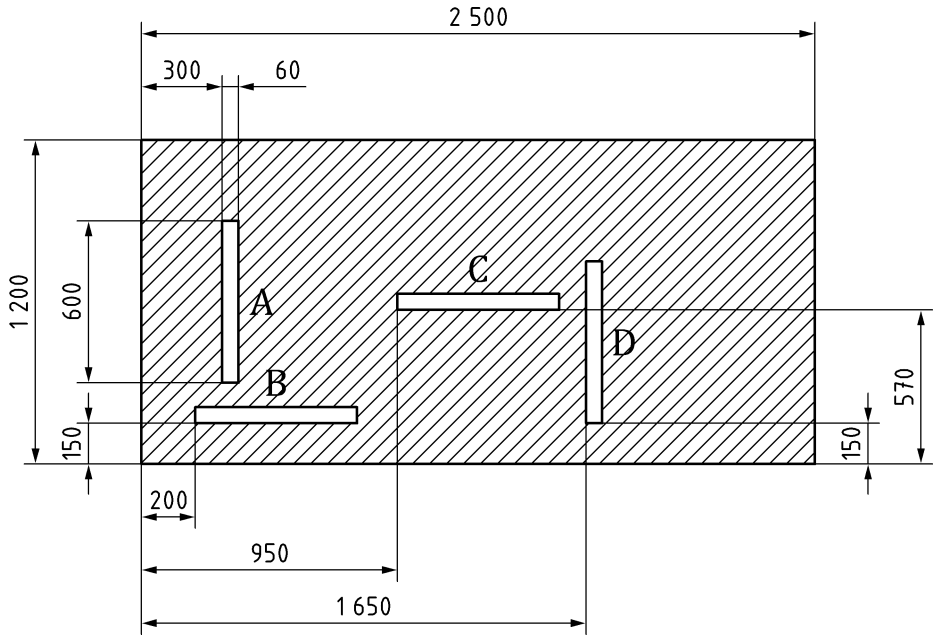



**Figure F.1 — Sampling of the beam on the plasterboard (distance in mm)**

The second point to clarify deals with the measurement conditions. For plasterboard purpose, we can be less restrictive than for the laminated glazing on the temperature condition, but more precise on the hygrometric conditions (samples have to be stored 24 h (or until the stabilization of the mass per unit of area) in those conditions before the test):

— temperature: (20 ± 3) °C;

— hygrometry: (50 ± 10) %.

Except those two points the measurement will fulfil the ISO 16940 standard for all the other technical requirements.

Then for the calculation of the dynamic Young modulus of the plasterboard of 12,5 mm, you will have to consider the three first modes of the beam. The dynamic Young modulus (with Formula [F.1]) is deducted from the equivalent bending stiffness (according to Annex B of ISO 16940:2008) for the four samples at each of the three first modes.

$$E = B\ h^3 / 12 \qquad [F.1]$$

with

*h* is the thickness of the board in m;

*B* is the equivalent bending stiffness N.m;

*E* is the dynamic Young modulus $N/m^2$.

The dynamic Young modulus of the board will be the average of the dynamic Young modulus of the four beams samples at the 3 first modes.

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