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TEST REPORT No. 286578

Place and date of issue: Bellaria-Igea Marina - Italy, 21/09/2011

Customer: C. & P. COSTRUZIONI S.r.l. - Via d'Este, 5/7-5/8 - 42028 POVIGLIO (RE) - Italy

Date test requested: 09/05/2011

Order number and date: 52804, 10/05/2011

Date specimen received: 21/04/2011

Test date: from 04/08/2011 to 08/08/2011

Purpose of test: laboratory measurements of airborne sound insulation of a partition in accordance with standards UNI EN ISO 10140-2:2010 and UNI EN ISO 717-1:2007

Test site: Istituto Giordano S.p.A. - Via Erbosa, 78 - 47043 Gatteo (FC) - Italy

Specimen origin: sampled and supplied by the Customer

Identification of specimen received: No. 2010/0964

Specimen name*

The shuttering blocks used to build the test specimen are called "ISOTEX HB 25/16 BLOCKS".



(*) according to that stated by the Customer.

LAB N° 0021

Comp. AV
Revis. RB

This test report consists of 12 sheets.
This document is the English translation of the test report No. 286578 dated 21/09/2011 issued in Italian; in case of dispute the only valid version is the Italian one. Date of translation: 26/06/2015.

Sheet
1 of 12

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Description of specimen*

The specimen is a partition wall tested in 2 different configurations in accordance with the type of covering utilised and having the dimensions given in the following table.

Nominal width	3600 mm
Nominal height	3000 mm
Nominal thickness of wall in configuration "A"	280 mm
Nominal thickness of wall in configuration "B"	320 mm
Effective sound-absorbing area	10,80 m ²

More specifically, the specimen is a wall made from Customer-manufactured ISOTEX HB 25/16 mineralised-wood-chip concrete shuttering blocks, dry laid with a half-block stagger between courses and having two cavities filled with concrete, measured thickness 160 mm per cavity and average measured density 2230 kg/m³, having the following physical properties:

Measured length	500 mm
Measured height	250 mm
Measured thickness	250 mm
Measured weight	10,0 kg

The specimen was mounted in the test opening by Istituto Giordano staff.

Wall in configuration "A"

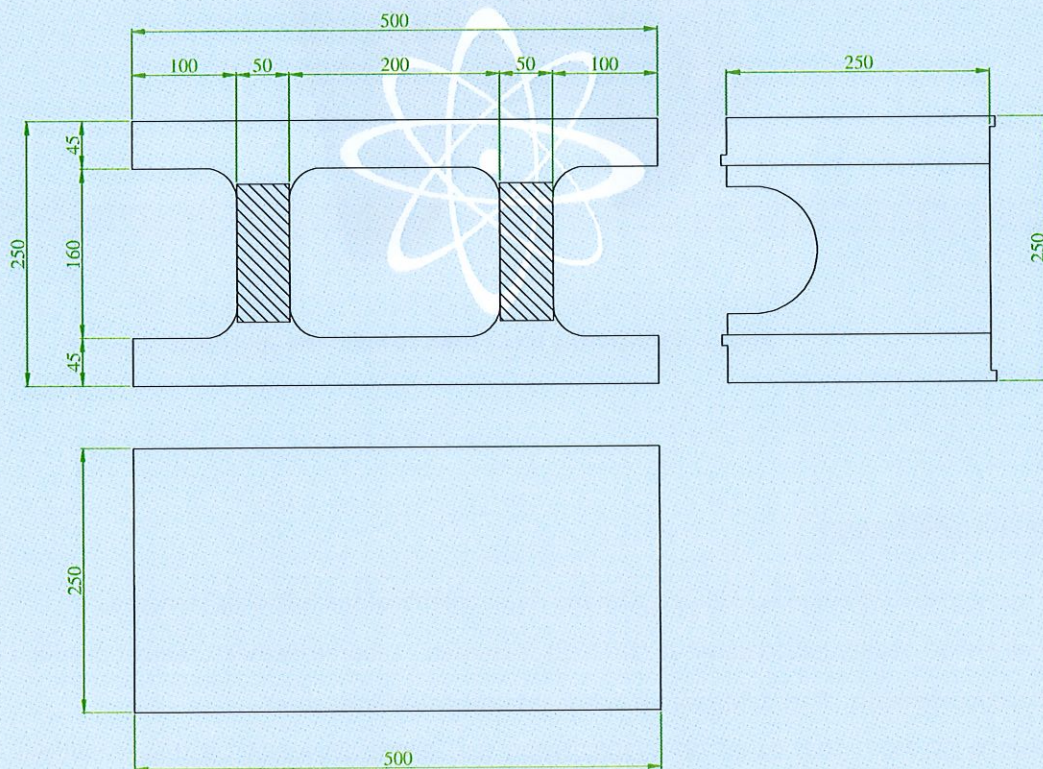
The wall in configuration "A" is covered on both faces by a layer of conventional cement-mortar plaster, average measured thickness 15 mm and average measured density 1900 kg/m³.

(*) according to that stated by the Customer, apart from characteristics specifically stated to be measurements.

Wall in configuration "B"

The wall in configuration "B" is lined on both faces with ISOLGYPSUM FIBRA drywall manufactured by the company Tecnasfalti S.r.l. - Via dell'Industria, 12 - Località Francolino - 20080 Carpiano (MI) - Italy and formed, starting from the side touching the wall, by

- IsolFIBTEC PFT board comprising a fibre-based technical fabric whose density increases along the thickness direction, nominal thickness 20 mm, bonded to the wall with gypsum-based adhesive using the dot and dab method, dabs being approx. 100-120 mm in diameter and spaced approx. 200 mm apart;
- layer of gypsum plasterboard, nominal thickness 12,5 mm



Schematic drawing of shuttering block used to build the specimen

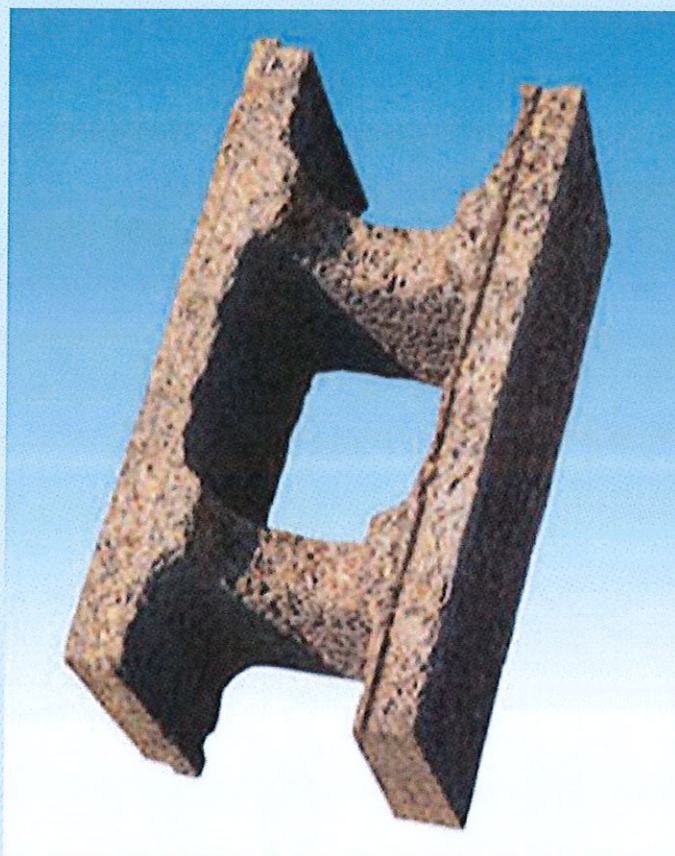


Photo of shuttering block used to build the specimen

Normative References

The test was carried out in accordance with the requirements of the following standards:

- UNI EN ISO 10140-2:2010 dated 21/10/2010 "Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation";
- UNI EN ISO 717-1:2007 dated 19/07/2007 "Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation".

Test apparatus

The following equipment was used to carry out the test:

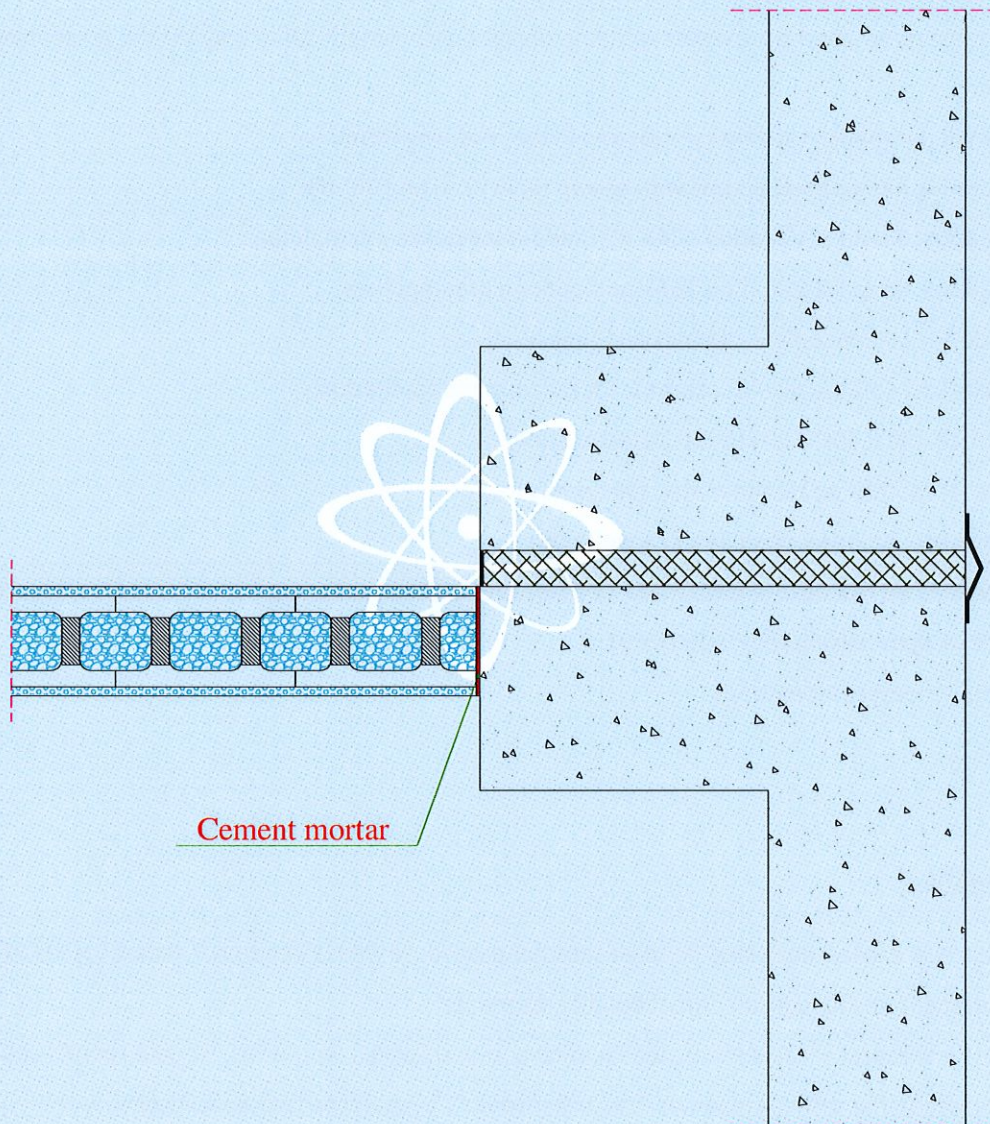
- LEM ENERGY 2 1000 W power amplifier;
- Behringer DEQ2496 digital 1/3-octave equaliser;
- portable dodecahedron speaker with line-of-sight path, length 1,6 m and 15° tilt, positioned in the source room;
- fixed dodecahedron speaker positioned in the receiving room;
- 2 rotating microphone booms with sweep radius 1 m and 30° tilt;
- 2 G.R.A.S. Sound & Vibration 40AR 1/2" random-incidence microphones;
- 2 G.R.A.S. Sound & Vibration 26AK microphone preamplifiers;
- 01 dB-Stell Symphonie 2-channel real-time analyser;
- 01 dB-Stell Cal21 acoustic calibrator for microphone calibration;
- Kern VB 150 K 50LM electronic platform scale;
- Sola Tri-Matic 5 m/19 mm metric tape measure;
- Bosch DLE 50 Professional laser rangefinder;
- 2 Delta Ohm HD206-2 and HD206S1 temperature and humidity loggers with combined probe;
- Brüel & Kjær barometer - type UZ001;
- complementary accessories.

Test method

The test was carried out using detailed internal procedure PP017 revision 7 dated 03/11/2010 "Laboratory measurement of sound insulation of building elements".

The test environment consists of two chambers, one of which, known as "source room", contains the noise source, whilst the other, known as "receiving room", is characterised acoustically by the equivalent sound absorption area.

After conditioning for at least 24 h in the measuring rooms, the specimen was installed in the test opening as shown in the following drawing.



Close-up of specimen positioning in the opening between the two rooms of the test environment

Following installation of the specimen, the sound pressure level was measured in the 1/3-octave frequency range 100 Hz to 5000 Hz in both source and receiving room and the latter's reverberation times in the same operating range were recorded; pink noise was used to generate the sound field.

The single-number quantity "Rw" of the sound reduction index "R" is equal to the value in dB of the reference curve at 500 Hz in accordance with the method specified by standard UNI EN ISO 717-1:2007.

The sound reduction index "R", equal to 10 times the common logarithm of the ratio of the sound power which is incident on the test specimen to the sound power transmitted through the specimen, was calculated using the following equation:

$$R = L_1 - L_2 + 10 \cdot \log \frac{S}{A}$$

where R = sound reduction index in dB;

L_1 = average sound pressure level in the source room, in dB;

L_2 = average sound pressure level in the receiving room, in dB, adjusted for background noise and calculated using the following equation:

$$L_2 = 10 \cdot \log \left[10^{\frac{L_{2b}}{10}} - 10^{\frac{L_b}{10}} \right]$$

where L_{2b} = combined average sound pressure level of signal and background noise in dB;

L_b = average background noise level in dB;

if the difference between the levels [$L_{2b} - L_b$] is less than 6 dB, a maximum correction of 1,3 dB is applied and the corresponding value of the sound reduction index "R" shall be considered a measurement limit value;

S = specimen effective sound-absorbing surface area, in m^2 ;

A = equivalent sound absorption area in the receiving room, expressed in m^2 , in turn calculated using the following equation:

$$A = \frac{0,16 \cdot V}{T}$$

where V = receiving room volume, expressed in m^3 ;

T = reverberation time, in seconds.

Furthermore, as proposed by standard UNI EN ISO 717-1:2007, 2 adaptation terms have been calculated in dB that take account of the characteristics of certain source sound spectra, more specifically:

- adaptation term “C” to be added to single-number rating “ R_w ” with source spectrum for A-weighted pink noise;
- adaptation term “ C_{tr} ” to be added to single-number rating “ R_w ” with source spectrum for A-weighted traffic noise.

There was a gap of 8 days between completing the basic wall and carrying out the test the first test.

Uncertainty of measurement

Uncertainty of measurement was determined in accordance with standard UNI CEI ENV 13005:2000 dated 31/07/2000 “Guide to the expression of uncertainty in measurement”, by calculating for each frequency the number of effective degrees of freedom “ ν_{eff} ” and expanded uncertainty “U” of the sound reduction index “R”, using a coverage factor “k” representing a confidence level of 95 %.

Uncertainty of measurement of the weighted sound reduction index “ $U(R_w)$ ” is calculated with a coverage factor $k = 2$ representing a confidence level of 95 %.

Average environmental conditions during test

	Source room	Receiving room
Atmospheric pressure	1014 mbar	1014 mbar
Average temperature	26 °C	26 °C
Average relative humidity	60 %	60 %

Test results**Wall in configuration "A"**

Receiving room volume "V"	105,5 m ³
Specimen net measuring area "S"	10,80 m ²

Frequency [Hz]	L ₁ [dB]	L ₂ [dB]	T [s]	R [dB]	R _{ref} [dB]	v _{eff}	k	U [dB]
100	95,3	61,0	2,47	36,3	37,0	6	2,45	2,6
125	101,8	61,5	1,87	41,1	40,0	6	2,45	2,0
160	101,4	60,7	1,58	40,7	43,0	9	2,26	1,1
200	94,5	54,2	1,54	40,2	46,0	9	2,26	0,9
250	95,8	50,3	1,40	45,0	49,0	11	2,00	0,8
315	93,9	46,0	1,41	47,5	52,0	12	2,00	0,7
400	94,9	44,9	1,39	49,5	55,0	13	2,00	0,4
500	95,2	42,3	1,63	53,1	56,0	11	2,00	0,4
630	95,0	38,8	1,61	56,3	57,0	9	2,26	0,5
800	94,9	36,6	1,48	58,1	58,0	10	2,23	0,4
1000	94,1	35,4	1,54	58,6	59,0	16	2,00	0,3
1250	91,8	31,7	1,50	59,9	60,0	11	2,00	0,6
1600	94,6	34,1	1,44	60,1	60,0	14	2,00	0,3
2000	96,1	35,2	1,41	60,5	60,0	14	2,00	0,3
2500	95,2	34,9	1,37	59,7	60,0	14	2,00	0,3
3150	96,9	39,6	1,28	56,4	60,0	13	2,00	0,3
4000	95,2	41,1	1,22	53,0	//	10	2,23	0,4
5000	98,1	43,0	1,11	53,6	//	13	2,00	0,3

Notes: //



Wall in configuration "A"



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Specimen net measuring area:

10,80 m²

Source room volume:

109,6 m³

Receiving room volume:

105,5 m³

Test result*:

Single-number rating at 500 Hz in the frequency range 100 Hz to 3 150 Hz:

R_w = 56 dB**

Adaptation terms:

C = -2 dB

C_{tr} = -6 dB

(*) Evaluation based on laboratory measurement results obtained by an engineering method.

(**) Single-number quantity of sound reduction index measured in steps of 0,1 dB:

56,1 dB

Uncertainty of measurement of the single number quantity U(R_w):

0,2 dB



— Test plot
 - - - Reference curve

Wall in configuration "B"

Receiving room volume "V"	105,0 m ³
Specimen net measuring area "S"	10,80 m ²

Frequency [Hz]	L₁ [dB]	L₂ [dB]	T [s]	R [dB]	R_{ref} [dB]	v_{eff}	k	U [dB]
100	96,6	67,1	1,51	29,4	42,0	5	2,57	2,7
125	99,9	64,5	1,35	34,8	45,0	7	2,36	1,9
160	101,0	56,7	1,38	43,8	48,0	10	2,23	1,1
200	96,5	47,8	1,29	47,9	51,0	8	2,31	0,9
250	98,1	44,1	1,29	53,2	54,0	7	2,36	0,8
315	97,0	39,7	1,39	56,8	57,0	10	2,23	0,7
400	98,2	37,6	1,33	59,9	60,0	12	2,00	0,4
500	98,0	35,2	1,43	62,4	61,0	14	2,00	0,5
630	98,3	32,6	1,46	65,4	62,0	9	2,26	0,5
800	98,2	30,7	1,46	67,2	63,0	9	2,26	0,4
1000	97,8	28,4	1,46	69,1	64,0	14	2,00	0,3
1250	95,1	23,9	1,38	70,7	65,0	17	2,00	0,4
1600	98,2	31,3	1,47	66,7	65,0	15	2,00	0,3
2000	100,0	32,4	1,41	67,2	65,0	12	2,00	0,3
2500	99,5	33,0	1,35	65,9	65,0	12	2,00	0,3
3150	101,3	34,6	1,28	65,9	65,0	12	2,00	0,3
4000	99,6	30,0	1,20	68,5	//	10	2,23	0,4
5000	99,5	26,5	1,13	71,6	//	16	2,00	0,4

Notes: //



Wall in configuration "B"



LAB N° 0021

Specimen net measuring area:

10,80 m²

Source room volume:

109,6 m³

Receiving room volume:

105,0 m³

Test result*:

Single-number rating at 500 Hz in the frequency range 100 Hz to 3 150 Hz:

R_w = 61 dB**

Adaptation terms:

C = -6 dB

C_{tr} = -13 dB

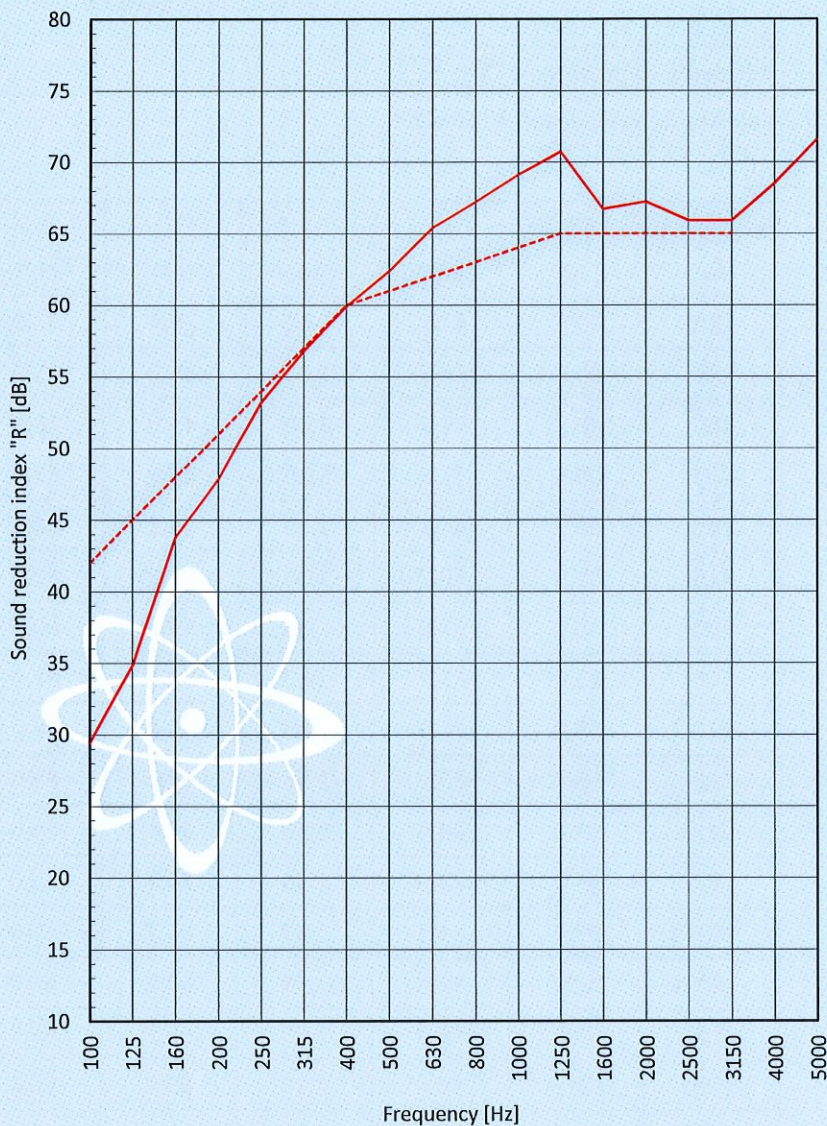
(*) Evaluation based on laboratory measurement results obtained by an engineering method.

(**) Single-number quantity of sound reduction index measured in steps of 0,1 dB:

61,1 dB

Uncertainty of measurement of the single number quantity U(R_w):

0,4 dB



— Test plot
 - - - Reference curve

Test Technician:
Geom. Omar Nanni

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Dott. Ing. Roberto Baruffa

Chief Executive Officer
(Dott. Arch. Sara Lorenza Giordano)

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