



INGURUMENA, LURRALDE PLANGINTZA
ETA ETXEBIZITZA SAILA

Etxebizitza, Lurzoru eta Arkitektura Zuzendaritza
Eraikuntzaren Kalitate Kontrolerako Laborategia

DEPARTAMENTO DE MEDIO AMBIENTE,
PLANIFICACIÓN TERRITORIAL Y VIVIENDA

Dirección de Vivienda, Suelo y Arquitectura
Laboratorio de Control de Calidad de la Edificación

AKUSTIKA ARLOA kudeatzailea:
ACOUSTICS AREA managed by:



Test Report No. B2021-LACUS-IN-146-1

Laboratory measurements of sound absorption

TEST SPECIMEN: Configuration of panels *ISINAC de 2cm de espesor acabado izer adhered con autoadhesivo.*

APPLICANT: ISINAC ACOUSTIC WORLD, S.L.
Calle López de Neira 3, 3º - Oficina 301
36203 VIGO

USED STANDARD: EN ISO 354:2003. Measurement of sound absorption in a reverberation room.

ISSUE DATE: 4th June 2021

Signature:

Technical Consultant
Susana Lopez de Aretxaga

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THIS REPORT CONTAINS:

Total number of pages: 7



This document includes only and exclusively the test specimen and the moment and conditions in which those measurements were made.

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The test specimen has been subjected to the test asked by the applicant, following the specified procedures in the used standards.

Test results are detailed in the inside pages. Uncertainty of measurement is available to the applicant.



1. TEST SPECIMEN DESCRIPTION

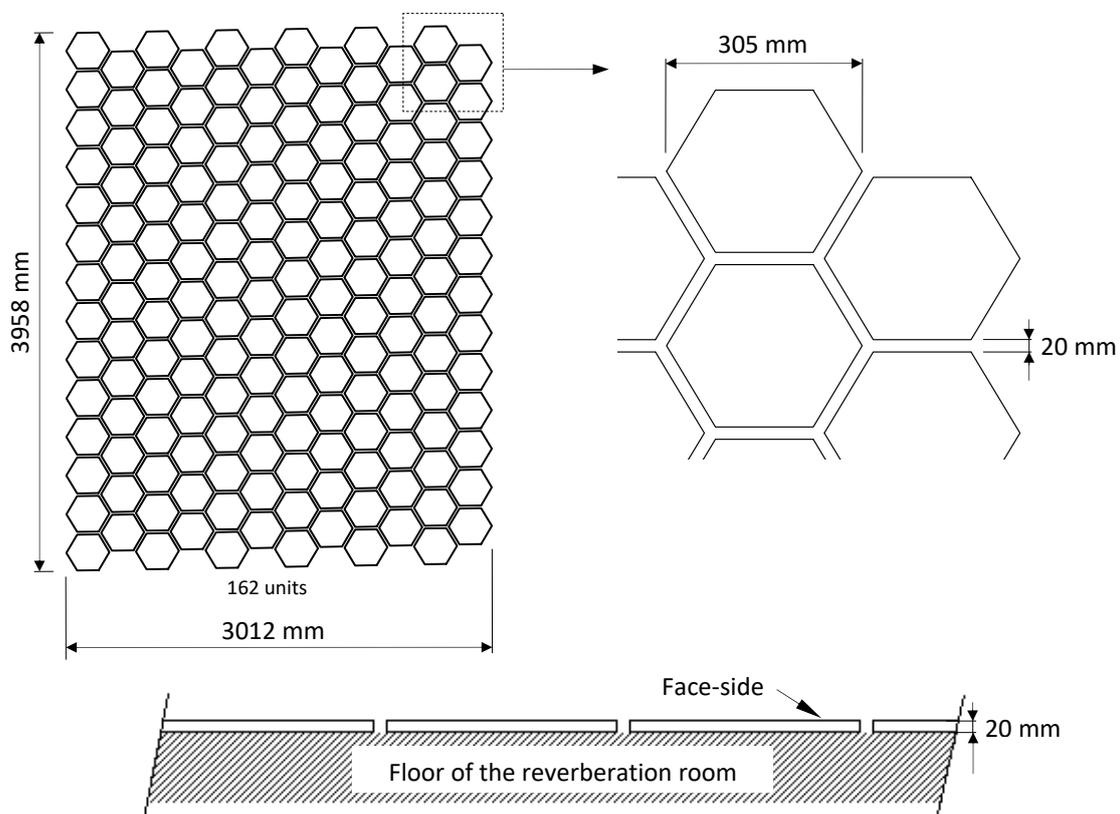
The test specimen consists of a configuration of panels, as detailed below according to the information provided by the applicant:

Description of the panel:

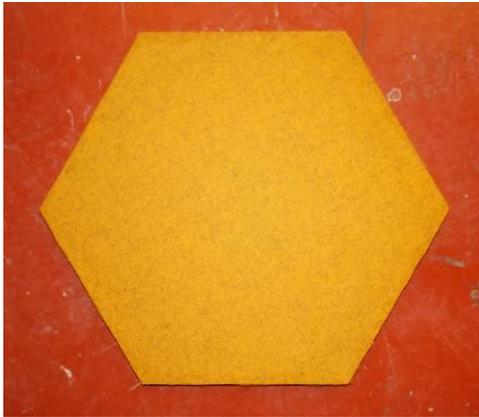
Reference:	<i>ISINAC de 2cm de espesor acabado izer adhered con autoadhesivo</i>
Material:	Basotect G+ open cell melamine foam (20 mm & 9 kg/m ³ of nominal density) with adhesive on the hidden face + IZZER Fabric (100% VIRGIN WOOL & 460 gr/m ² of grammage) adhered on the face-side
Nominal dimensions:	Regular hexagon 20 mm thick and 305 mm main diagonal

Arrangement of the test specimen

The panels are placed on the floor of the reverberation room, with a distance of 20 mm between them, with the hidden face oriented towards the floor of the test room and covering a surface of 11,92 m², according to the following sketches:



Arrangement of the test specimen (B2021-146-M839)



Photos of panels (face-side)



Photos of the mounting of the test specimen

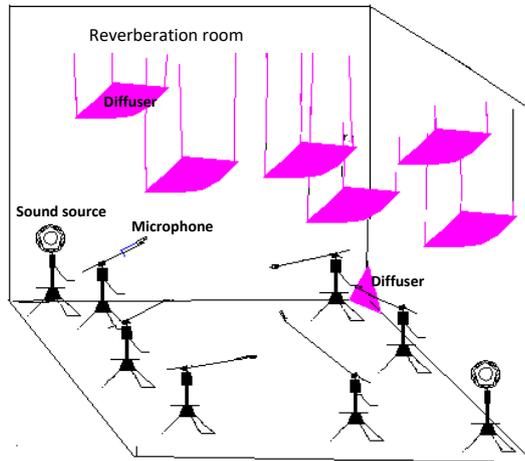
Panels selected and delivered by: applicant

Mounting performed by: Tecnalia

Date of end of mounting: 3rd May 2021

2. LABORATORY TEST FACILITIES

The test is performed in the reverberation room. This room is a regular parallelepiped of 7x6x5 meters with a total surface area of 211,8 m² (walls, floor and ceiling). The sound field diffusivity of the room is obtained by means of twenty diffusers (between 1 and 1,2 m²) suspended from the ceiling of the room and eight edged diffusers. The room complies with the requirements of EN ISO 354:2003.



Sketch of the reverberation room

3. EQUIPMENT AND TEST CONDITIONS

	Reverberation room
Microphone	Brüel&Kjær 4943; Serial No. 3188435
Preamplifier	Brüel&Kjær 2669; Serial No. 2025844
Sound source	Brüel&Kjær 4296; Serial No. 2071428

	Control room
Analyzer	Nor850-MF1; Serial No. 8501186
Amplifier	LAB 300; Serial No. 970-967
Equalizer	Sony, SRP-E100; Serial No. 400238
Calibrator	Brüel&Kjær 4231; Serial No. 2061477
Atmospheric conditions meter	Rotronic BL-1D; Serial No. A19060062

Uncertainty in the measurement of atmospheric conditions:	
Air temperature	±0,5 °C
Air humidity	±4 %
Atmospheric pressure	±2 mbar



4. TEST PROCEDURE AND EVALUATION

The sound absorption coefficient, α_s , is calculated for the one-third-octave band 100 Hz to 5 kHz according to standard EN ISO 354:2003, using the following formula:

$$\alpha_s = A_T/S$$

A_T : Equivalent sound absorption area of test specimen, in square metres.

S : Area covered by the test specimen, in square metres.

The equivalent sound absorption area of test specimen is calculated according to the following formula:

$$A_T = 55,3 \cdot V \cdot \left(\frac{1}{c_2 \cdot T_2} - \frac{1}{c_1 \cdot T_1} \right) - 4 \cdot V (m_2 - m_1)$$

V : Volume of the empty reverberation room, in cubic metres.

c_1 : Propagation speed of sound in air, in metres per second, in the empty reverberation room.

c_2 : Propagation speed of sound in air, in metres per second, in the reverberation room with the test specimen.

T_1 : Reverberation time, in seconds, of the empty reverberation room.

T_2 : Reverberation time, in seconds, of the reverberation room with the test specimen installed.

$m_1; m_2$: Power attenuation coefficients, in reciprocal metres, calculated according to ISO 9613-1, using the climatic conditions in the reverberation room.

Reverberation time measurements are performed using equalized emission pink noise, in two omni-directional sound source positions and six fixed microphone positions. For each microphone and source position, the reverberation time is obtained as an average of five decays in each third octave band from 100 Hz to 5 kHz.

Measuring chain is verified just before and after the execution of the test.

The guidelines indicated in the applicable internal procedures have been followed:

- PE.MC-AA-63-E: "Procedure to determine the sound absorption in a reverberation room, according to Standard EN ISO 354".
- PE.MC-AA-06-M: "Procedure to manage the test specimens for acoustic tests in laboratory".

5. RESULTS

The following results are featured for the test specimen:

- Reverberation times measured in the reverberation room without test specimen (T_1) and with test specimen (T_2).
- Sound absorption coefficient, α_s , per one-third octave band from 100 Hz to 5000 Hz, in table and graph.
- The following parameters obtained according to Standard EN ISO 11654:1997, from the sound absorption coefficient α_s in frequency bands:
 - Practical sound absorption coefficient, α_{pi} , per one-third octave frequency bands from 125 to 4000 Hz.
 - Weighted sound absorption coefficient, α_w .
 - Shape indicators: L.M.H.



Sound Absorption according to EN ISO 354:2003 Laboratory measurements

Applicant: ISINAC ACOUSTIC WORLD, S.L.

Result No.: B2021-146-M839

Test date: 3rd May 2021

Test specimen: Configuration of panels ISINAC de 2cm de espesor acabado izer adhered con autoadhesivo.



Area, S, test: 11,92 m²

Volume of reverberation room: 209,6 m³

t₁: 18,4 °C

HR₁: 52 %

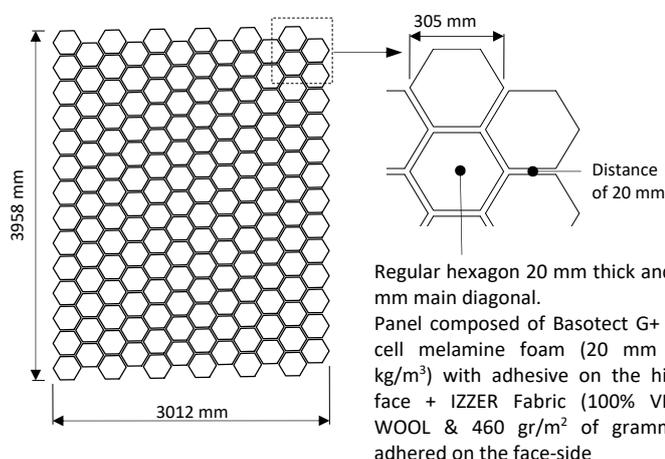
P₁: 961 mbar

t₂: 18,4 °C

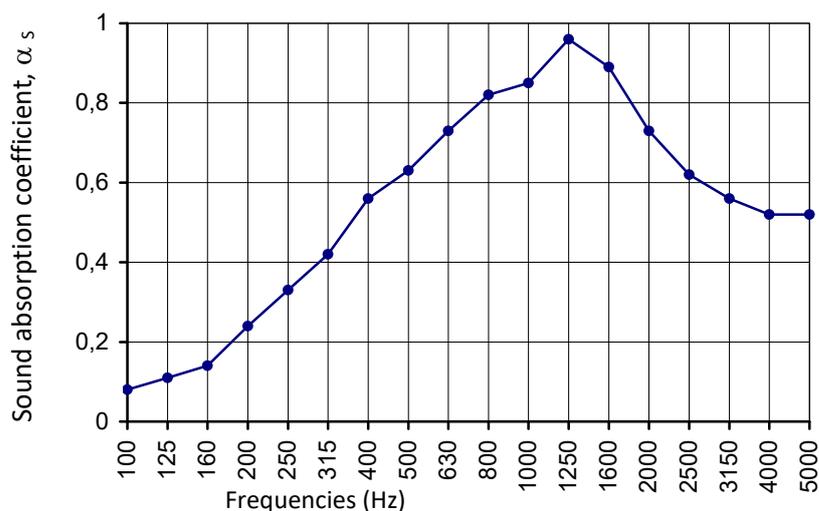
HR₂: 52 %

P₂: 963 mbar

1. Empty room
2. Room with the test specimen



f (Hz)	T ₁	T ₂	α _s	α _p
100	8,75	7,07	0,08	0,10
125	8,17	6,24	0,11	
160	8,69	6,05	0,14	
200	9,52	5,30	0,24	0,35
250	9,42	4,47	0,33	
315	8,35	3,74	0,42	
400	8,54	3,18	0,56	0,65
500	9,00	3,01	0,63	
630	8,65	2,69	0,73	
800	8,12	2,44	0,82	0,90
1000	7,55	2,32	0,85	
1250	6,93	2,07	0,96	
1600	6,21	2,11	0,89	0,75
2000	5,29	2,23	0,73	
2500	4,39	2,24	0,62	
3150	3,54	2,08	0,56	0,55
4000	2,79	1,84	0,52	
5000	2,06	1,49	0,52	



Evaluation according to EN ISO 11654:1997:

Weighted sound absorption coefficient: α_w = 0,65 (M)

Evaluation based on laboratory measurement obtained by an engineering method.

