



LURRALDE PLANGINTZA, ETXEBIZITZA
ETA GARRAIO SAILA

Etxebizitza, Lurzoru eta Arkitektura Zuzendaritza
Eraikuntzaren Kalitate Kontrolerako Laborategia

DEPARTAMENTO DE PLANIFICACIÓN
TERRITORIAL, VIVIENDA Y TRANSPORTES

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

Product-type report No. B2021-LACUS-IN-146-4

Laboratory measurements of sound absorption

AKUSTIKA ARLOA kudeatzailea:
ACOUSTICS AREA managed by:



TEST SPECIMEN: Suspended ceiling composed of panels '*ISINAC de 4cm de espesor acabado izer adhered*' and 400 mm air chamber.

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.

Initial type testing according to harmonised product standard EN 13964:2014.

Test for CE marking, System 3, according to European Regulation (EU) No 305/2011 - Construction Products Regulation (CPR).

ISSUE DATE: 21st July 2021

Signature:

Technical Consultant
Susana Lopez de Aretxaga

The facilities where acoustic tests are carried out belong to the Acoustics Area of the Laboratory for the Quality Control in Building of the Basque Government, located in Agirrelanda Street, 10, 01013 Vitoria – Gasteiz (Spain).

The technical ownership of the accreditation falls to Fundación Tecnalia Research & Innovation, the same way as the technical signatures of this report. The test is performed by personnel of TECNALIA (Industry Lab_services Area).

TECNALIA is Notified Body 1292 for the performance of the specified tests.



THIS REPORT CONTAINS:

Total number of pages: 8

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

TECNALIA does not take responsibility for the information supplied by the applicant.

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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.



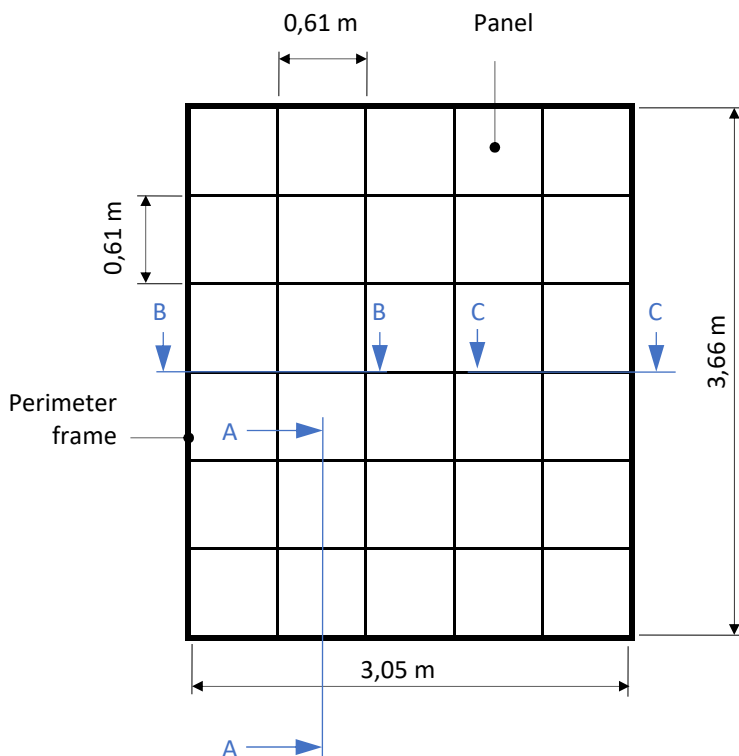
1. TEST SPECIMEN DESCRIPTION

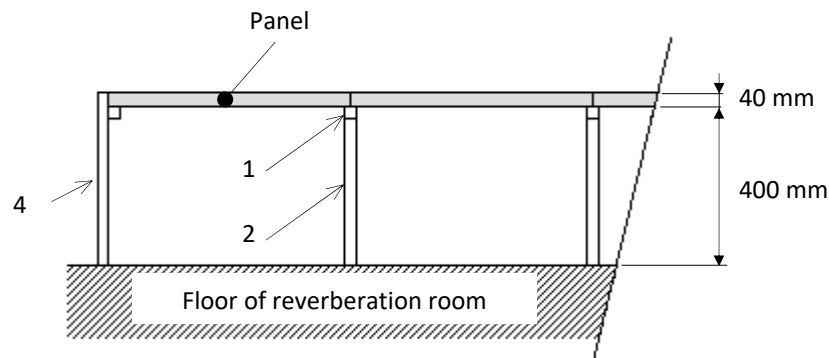
The test specimen consists of a suspended ceiling composed of panels and air chamber, as detailed below according to the information provided by the applicant:

Description of panel:

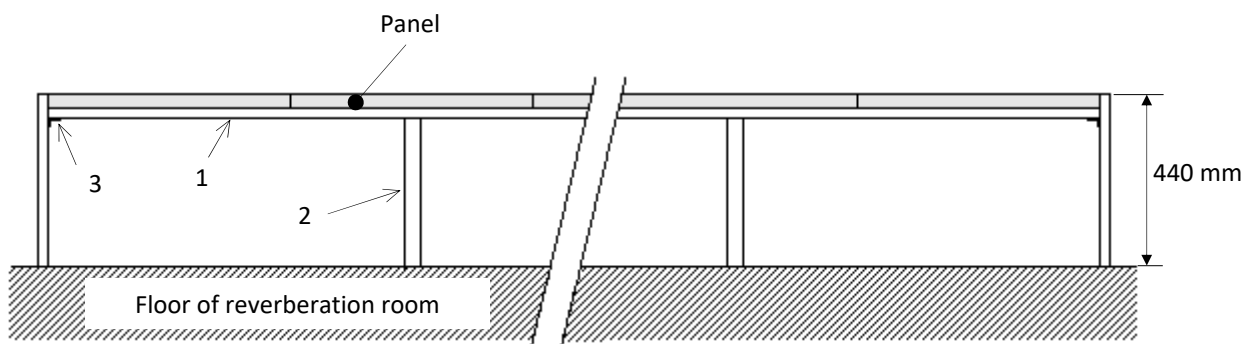
Reference:	<i>ISINAC de 4cm de espesor acabado izer adhered</i>
Material:	open cell foam (40 mm & 9 kg/m ³ of nominal density) + IZZER Fabric (100% VIRGIN WOOL & 460 gr/m ² of grammage) adhered on the face-side
Nominal dimensions:	40 mm thick & 610x610 mm

Arrangement of the test specimen:





Section AA



Section BB

Section CC

Butt joint between panels and between panels and perimeter frame.

Panels support structure:

- 1- MDF strip 30x30 mm and 3,05 m long (7 units, under panel joint)
- 2- MDF support 30x40 mm (10 units, 2 for each central strip)
- 3- Metallic bracket
- 4- Perimeter frame

Arrangement of test specimen (B2021-146-M842)



Photos of panel



Photos of mounting of test specimen



The test specimen is placed on the floor of the reverberation room, with the hidden face of panels oriented towards the floor, covering a surface of 11,16 m², within a 30 mm thick x 440 mm high MDF perimeter frame and sealing of joints frame-floor by adhesive tape.

Manufacturer of panels: ISINAC ACOUSTIC WORLD, S.L.

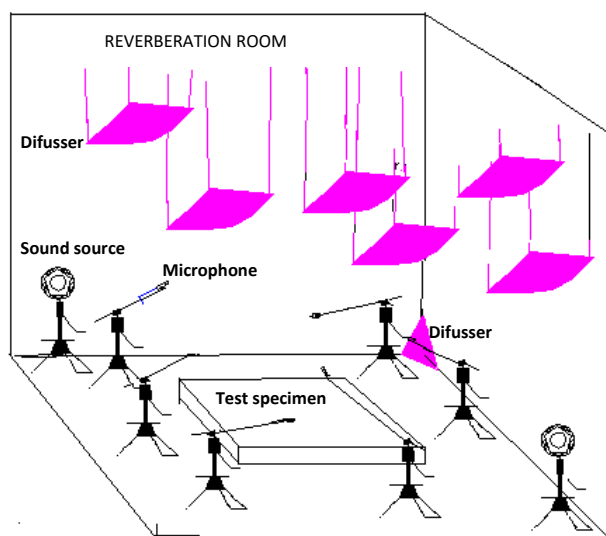
Panels selected and delivered by: applicant

Mounting performed by: Tecnalia

Date of end of mounting: 24th June 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 the empty reverberation room, in metres per second

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

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

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

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 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-M842

Test date: 24th June 2021

Test specimen: Suspended ceiling composed of panels 'ISINAC de 4cm de espesor acabado izer adhered' and 400 mm air chamber.

Test arrangement: Type E-440 mounting according to EN ISO 354:2003-Annex B.

Area, S, test: 11,16 m²

Volume of reverberation room: 209,6 m³

t₁: 20,4 °C

HR₁: 61 %

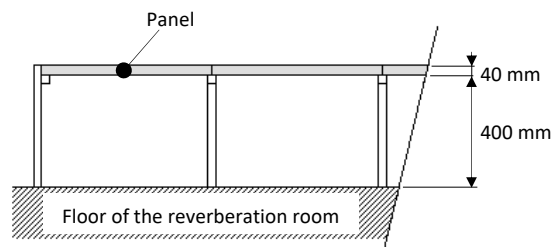
P₁: 958 mbar

t₂: 19,8 °C

HR₂: 57 %

P₂: 966 mbar

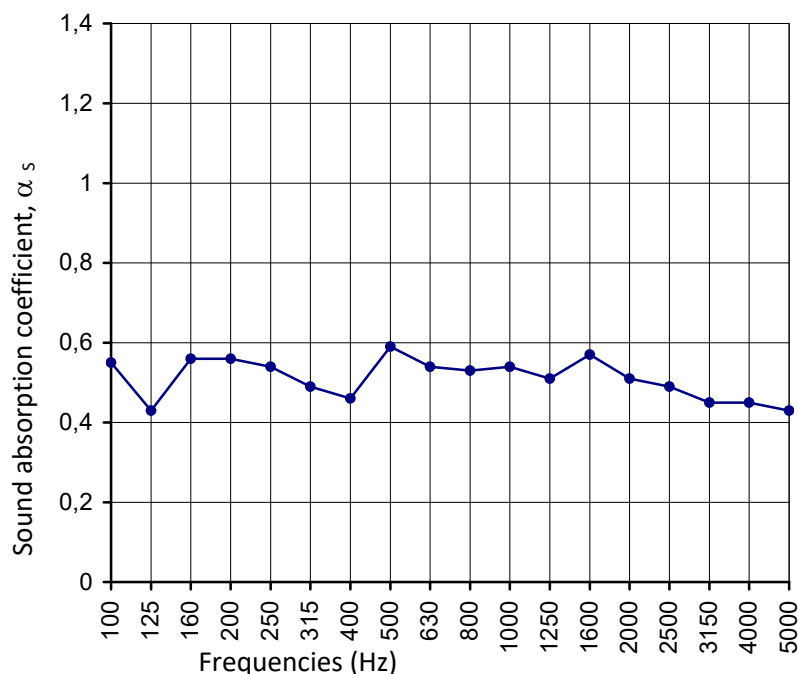
1. Empty room
2. Room with the test specimen



Panel composed of open cell foam (40 mm & 9 kg/m³) + IZZER Fabric (100% VIRGIN WOOL & 460 gr/m² of grammage) adhered on the face-side.

Panels support structure in MDF.

f (Hz)	T ₁	T ₂	α _s	α _p
100	8,90	3,39	0,55	0,50
125	7,96	3,72	0,43	
160	8,92	3,36	0,56	
200	10,19	3,52	0,56	0,55
250	9,74	3,56	0,54	
315	8,93	3,65	0,49	
400	8,70	3,77	0,46	0,55
500	9,29	3,30	0,59	
630	8,96	3,45	0,54	
800	8,50	3,41	0,53	0,55
1000	7,89	3,31	0,54	
1250	7,10	3,25	0,51	
1600	6,43	2,93	0,57	0,50
2000	5,53	2,85	0,51	
2500	4,73	2,67	0,49	
3150	3,83	2,41	0,45	0,45
4000	3,11	2,09	0,45	
5000	2,33	1,70	0,43	



Evaluation according to EN ISO 11654:1997:

Weighted sound absorption coefficient: α_w = 0,55

Evaluation based on laboratory measurement obtained by an engineering method

