



INGURUMENA, LURRALDE PLANGINTZA
ETA ETXEBIZITZA SAILA
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Eraikuntzaren Kalitate Kontrolerako Laborategia

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

Test Report No B2019-LACUS-IN-83 I

Laboratory measurements of sound absorption

AKUSTIKA ARLOA kudeatzailea:
ACOUSTICS AREA managed by:



TEST SPECIMEN: Configuration of ISINAC HYBRID panels.

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: 26th November 2019

Signature:

Technical Consultant

Susana Lopez de Aretxaga

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TECNALIA is Notified Body 1292 according to Regulation (EU) No 305/2011 - Construction products Regulation (CPR) for the specified acoustic 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.

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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:	ISINAC HYBRID
Size:	1240 mm high x 275 mm width x 108-223 mm variable thickness
Composition:	Frame: Birch plywood board of 15 mm and 9 mm thick. Inner material: Open cell melamine foam 'Basotect' of 60-120 mm variable thickness and 9 kg/m³ nominal density. External material: Lucia CS fabric (fire-resistant 100% Trevira CS polyester of 230 gr/m²) on the face side and edges.

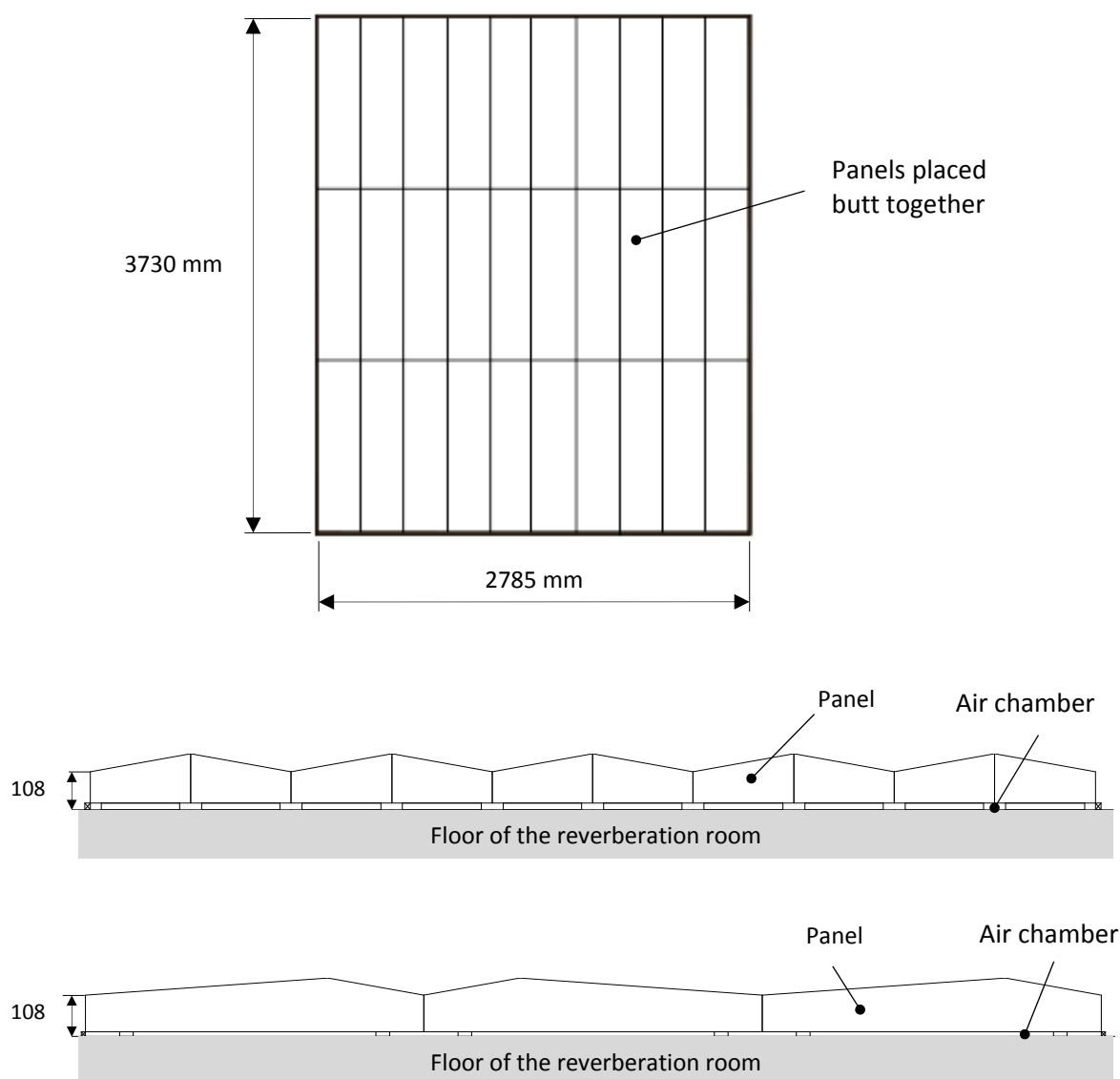


Photos of the panel (face side) (cotes in mm)

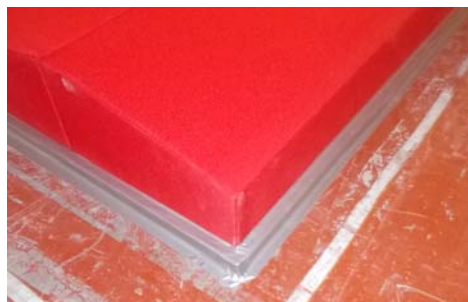


Arrangement of the test specimen:

The installation of the panels in the reverberation room is done according to the specifications of the applicant. The panels are mounted butt together on the floor of the reverberation room, with the hidden face oriented towards the floor of the test room. The perimeter of the test specimen is closed with a wooden frame of 18 mm high x 15 mm thick and the frame-floor joints have been sealed with adhesive tape.



Arrangement of the test specimen (B2019-83-M657) (cotes in mm)



Photos of the mounting of the test specimen

Manufacturer of the specimen: applicant

Panels selected and delivered by: applicant

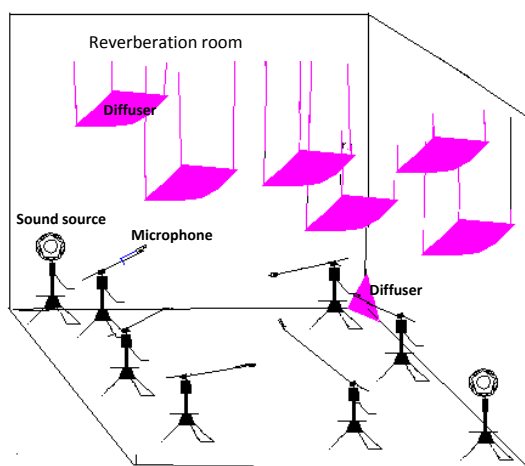
Mounting performed by: Tecnalia

Date of end of mounting: 29th October, 2019



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 (walls, floor and ceiling) of 211.8 m². The sound field diffusivity of the room is obtained by means of twenty diffusers (0.8 m² - 1 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	B&K 4943; Serial No. 30933386
Preamplifier	B&K 2669; Serial No. 2025844
Sound source	B&K 4296; Serial No. 2071428

	Control room
Analyzer	Nor850-MF1; Serial No. 8501186
Amplifier	LAB Gruppen; LAB 300; Serial No. 970-967
Equalizer	Sony, SRP-E100; Serial No. 400238
Calibrator	Brüel & Kjær 4231; Serial No. 2061476
Atmospheric conditions meter	Ahlborn Almemo 2590-3S; No. H09121017

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 , of a test specimen 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, including the area of the edges.

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.

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 sources positions and six fixed microphone positions. For each microphone and source position, the reverberation time is determined 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 reverberation room without (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, calculated 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 , calculated according to EN ISO 11654:1997, plus its correspondent classification. Uncertainty associated to the global index α_w is $U=\pm 0,05\text{dB}$, which corresponds to the expanded uncertainty with coverage factor $k\approx 2$.
 - Shape indicators L.M.H, according to EN ISO 11654:1997.

Sound absorption according to EN ISO 354:2003 Laboratory measurements

Applicant: ISINAC ACOUSTIC WORLD, S.L.

Result N°: B2019-83-M657

Test date: 30th October 2019

Test specimen: Configuration of ISINAC HYBRID panels.

Test arrangement: Type A mounting according to EN ISO 354:2003.

Area, S, test: 11,8 m²

Reverberation room volume: 209,6 m³

t₁: 19,8 °C

HR₁: 60,0 %

P₁: 957 mbar

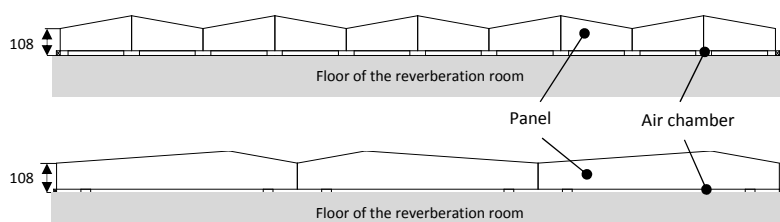
t₂: 20,0 °C

HR₂: 62 %

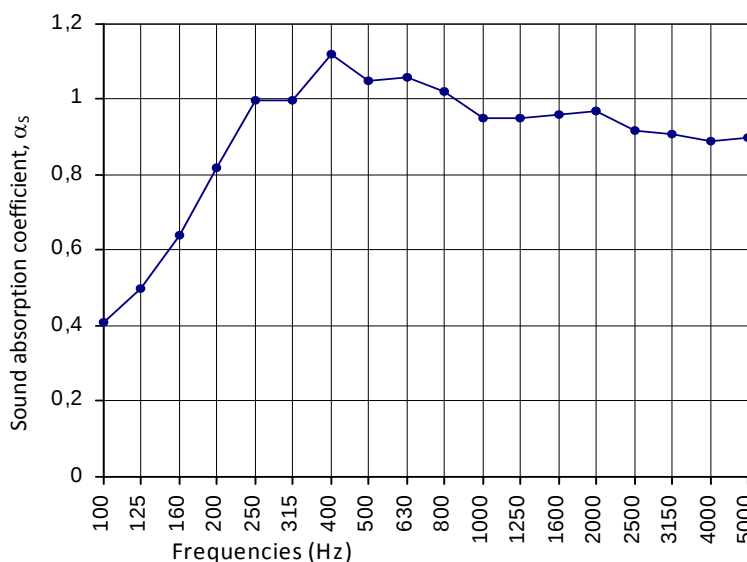
P₂: 959 mbar

1. Empty room

2. Room with test specimen



f (Hz)	T ₁	T ₂	α _s	α _p
100	10.27	4.15	0.41	0.50
125	8.56	3.42	0.50	
160	8.39	2.92	0.64	
200	8.99	2.51	0.82	
250	8.95	2.17	1.00	0.95
315	8.08	2.12	1.00	
400	8.21	1.95	1.12	1.00
500	8.38	2.05	1.05	
630	8.03	2.01	1.06	
800	7.22	2.02	1.02	0.95
1000	6.80	2.09	0.95	
1250	6.30	2.04	0.95	0.95
1600	5.73	1.96	0.96	
2000	5.09	1.87	0.97	0.90
2500	4.32	1.81	0.92	
3150	3.57	1.68	0.91	
4000	2.87	1.53	0.89	0.90
5000	2.19	1.31	0.90	



Evaluation according to EN ISO 11654:1997

Weighted sound absorption coefficient:

α_w = 1

Classification:

A

Evaluation based on laboratory measurement obtained by an engineering method.