EUSKO JAURLARITZA GOBIERNO VASCO

INGURUMENA, LURRALDE PLANGINTZA ETA ETXEBIZITZA SAILA
Etxebizitza eta Arkitektura Zuzendaritza
Eraikuntzaren Kalitate Kontrolerako Laborategia

DEPARTAMENTO DE MEDIO AMBIENTE, PLANIFICACIÓN TERRITORIAL Y VIVIENDA
Dirección de Vivienda y Arquitectura
Laboratorio de Control de Calidad de la Edificación

AKUSTIKA ARLOA kudeatzailea:
ACOUSTICS AREA managed by:

Test Report No B2019-LACUS-IN-54 II

Laboratory measurements of sound absorption

TEST SPECIMEN: Configuration of *ISINAC C.610.40 LUCIA CS ADH* panels with a separation of 400 mm from a surface.

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: 17th April, 2019

Signature:
Technical Consultant
Susana Lopez de Aretxaga

The technical-owned of the ENAC Nº4/LE456 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).

Facilities where measurements are carried out under the scope of ENAC Nº4/LE456 accreditation belong to the Acoustics Area of the Building Quality Control Laboratory of the Basque Government, placed at Agirrelanda Street, 10, 01013 Vitoria – Gasteiz (Spain).

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

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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

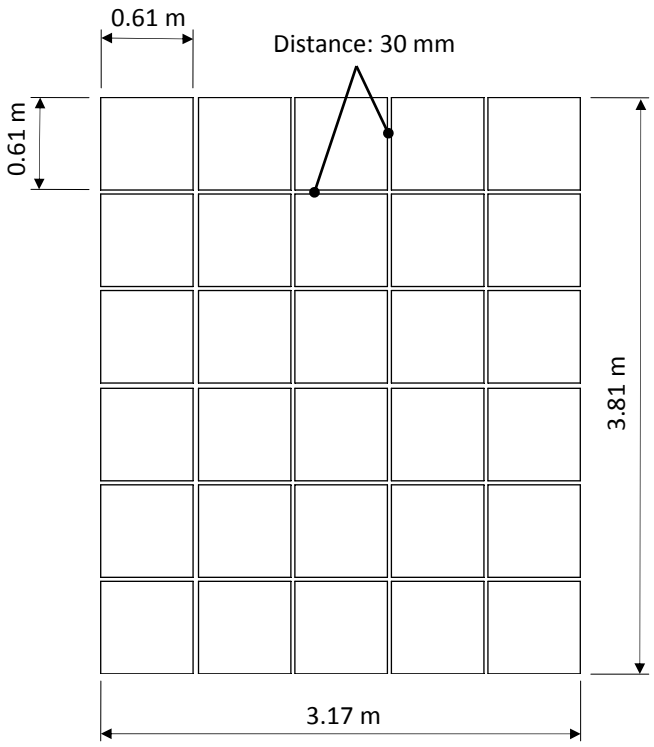
The test specimen consists of a configuration of panels separated from a surface, as detailed below according to the information provided by the applicant:

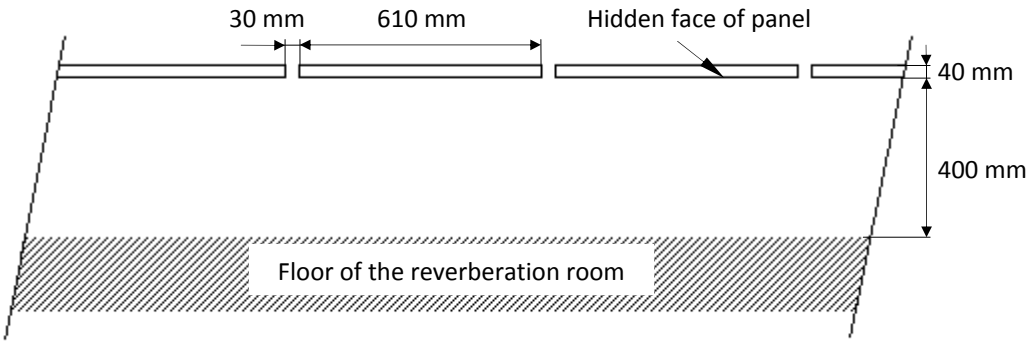
Description of the panel:

Reference:	*ISINAC C.610.40 LUCIA CS ADH.*
Material:	Basotect open cell melamine foam (40 mm & 9 kg/m^3 of nominal density) with 120 gr. adhesive on the hidden face + Lucía CS Fabric (100% Trevira CS polyester & 265 gr/m^2 of grammage) on the face-side and edges
Nominal dimensions:	610x610 mm & 40 mm thick

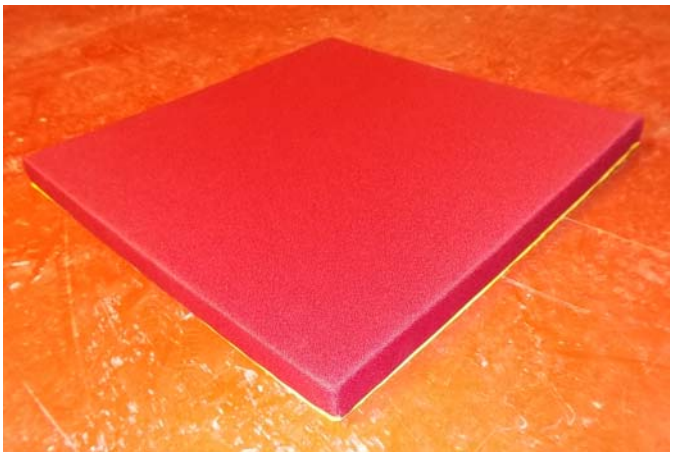
Arrangement of the test specimen

The panels are placed at 400 mm above the floor of the test room, with a distance of 30 mm between them, with the hidden face oriented towards the floor of the test room and covering a surface of 12.08 m^2, according to the following sketches:





Arrangement of the test specimen (B2019-54-M607)



Photos of the panel (face side)

Photos of the mounting of the test specimen

Installation of the test specimen in test room:

The panels have been placed over perimeter and central steel profiles and nylon threads subject to the profiles.

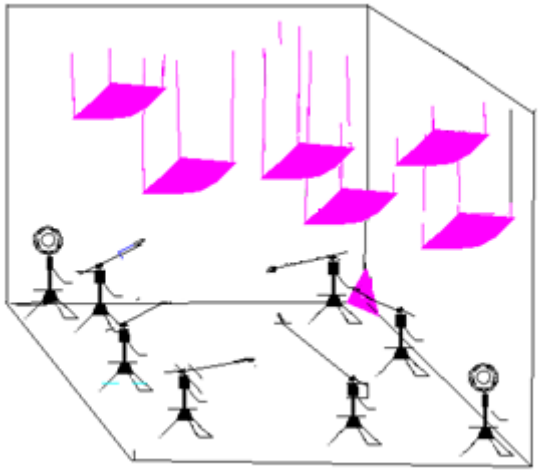
Panels selected and delivered by: applicant

Mounting performed by: Tecnalia

Date of end of mounting: 10th April, 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 of 211.8 m^2 (walls, floor and ceiling). The sound field diffusivity of the room is obtained by means of twenty diffusers (0.8 m^2 - 1 m^2) 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; Nº 2534064
Preamplifier	B&K 2669; Nº 1948764
Sound source	B&K 4296; Nº 2071428

	Control room
Analyzer	Brüel & Kjær 2144; Nº 1893979
Amplifier	LAB Gruppen;LAB 300; Nº 970-967
Equalizer	Sony, SRP-E100; Nº 400238
Calibrator	Brüel & Kjær 4231; Nº 2061477
Atmospheric conditions meter	Ahlborn Almemo 2590-3S; Nº H09121017

Uncertainty in the measurement of atmospheric conditions:	
Air temperature	±0,5 ºC
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:

$$\alpha_s = A_T/S \qquad \text{where,}$$

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:

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

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: B2019-54-M607

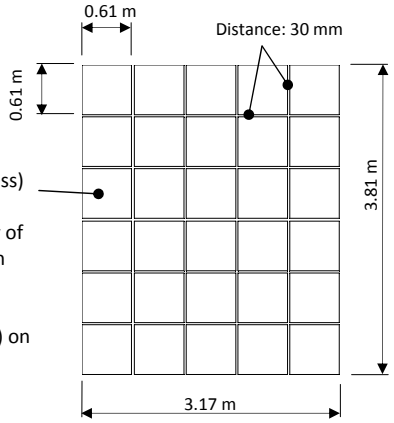
Test date: 10th April, 2019

Test specimen: Configuration of *ISINAC C.610.40 LUCIA CS ADH* panels with a separation of 400 mm from a surface.

Area, S, test: 12.08 m^2
Volume of reverberation room: 209.6 m^3

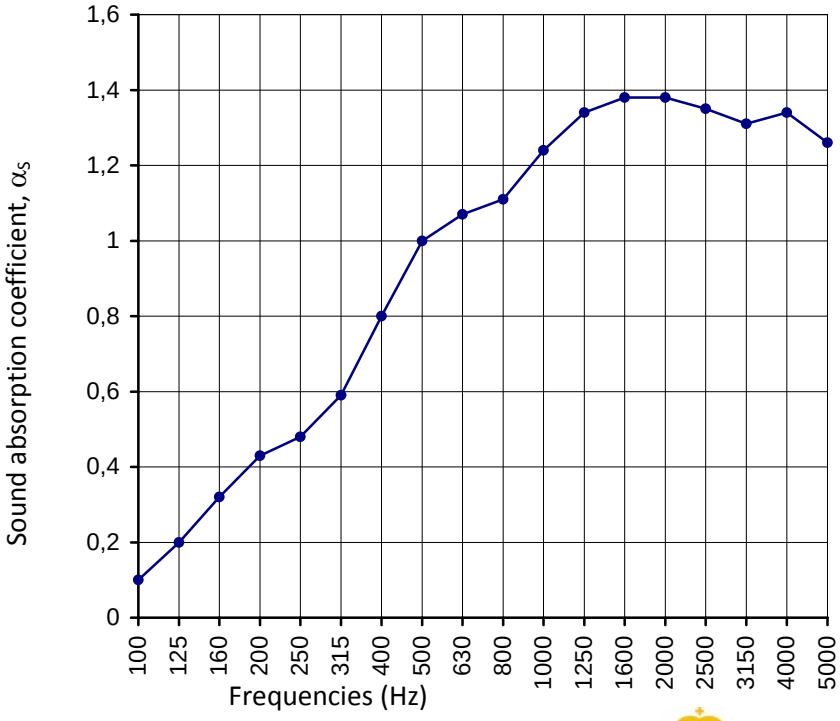
t_1 : 18.9 ºC
HR_1 : 48 %
P_1: 950 mbar
t_2 : 19.3 ºC
HR_2 : 53 %
P_2: 954 mbar

1. Empty room
2. Room with the test specimen



Panel (40 mm of nominal thickness) composed of: Basotect open cell melamine foam (nominal density of 9 kg/m^3) with 120 gr. adhesive on the hidden face + Lucía CS Fabric (100% Trevira CS polyester & nominal grammage of 265 gr/m^2) on face-side and edges.

f (Hz)	T_1	T_2	α_s	α_p
100	8.17	6.39	**0.10**	
125	7.73	4.99	**0.20**	**0.20**
160	9.18	4.51	**0.32**	
200	9.51	3.85	**0.43**	
250	9.38	3.60	**0.48**	**0.50**
315	8.27	3.01	**0.59**	
400	8.35	2.47	**0.80**	
500	8.89	2.13	**1.00**	**0.95**
630	8.47	2.00	**1.07**	
800	7.98	1.91	**1.11**	
1000	7.56	1.74	**1.24**	**1.00**
1250	6.82	1.60	**1.34**	
1600	6.07	1.52	**1.38**	
2000	5.26	1.47	**1.38**	**1.00**
2500	4.37	1.42	**1.35**	
3150	3.45	1.34	**1.31**	
4000	2.73	1.21	**1.34**	**1.00**
5000	2.02	1.09	**1.26**	



Evaluation according to EN ISO 11654:1997:

Weighted sound absorption coefficient: α_w = 0.80 (H)

Evaluation based on laboratory measurement obtained by an engineering method.

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