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PLANIFICACIÓN TERRITORIAL Y VIVIENDA

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AKUSTIKA ARLOA kudeatzailea:

ACOUSTICS AREA managed by:



Test Report No B2018-LACUS-IN-27 II_En

Laboratory measurements of sound absorption

TEST SPECIMEN: Configuration of 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 July, 2018**TRANSLATION DATE:** 21st March, 2019**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 tested specimen(s) and the moment and conditions in which those measurements were made.

This document is the English version of the report issued in Spanish, B2018-LACUS-IN-27 II (26th July, 2018). In case of law suit, the original document will be taken as reference.

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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: *ISINAC ILUCS ADH*.

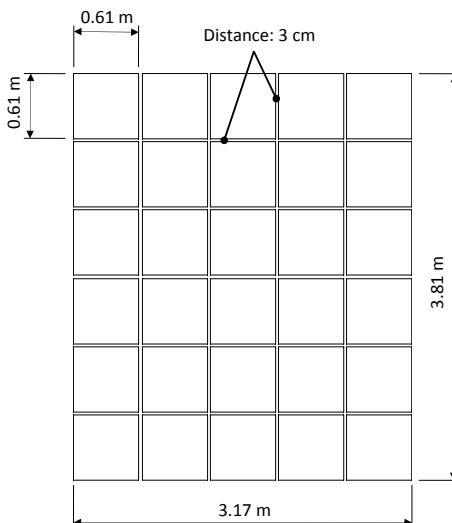
Description of the panel:

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

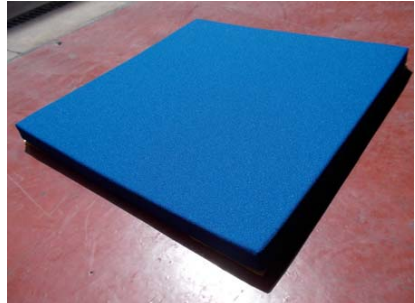
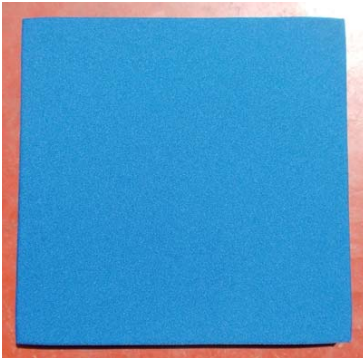
(*) Information provided by the applicant.

Arrangement of the test specimen

The panels were placed on the floor of the testing room, with a distance of 30 mm between them, with the fabric face exposed to the sound and covering a surface of 12.08 m², according to the following sketch.



Arrangement of the test specimen (B2018-27-M542)



Photos of the panel (face side)



Photos of the mounting of the test specimen

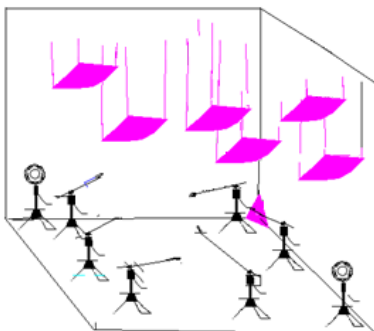
Material selected and delivered by: applicant

Mounting performed by: Tecnalia

Date of end of mounting: 10th July, 2018

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 (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; N° 2534064
Preamplifier	B&K 2669; N° 1948764
Sound source	B&K 4296; N° 2071428

	Control room
Analyzer	Brüel & Kjær 2144; N° 1893979
Amplifier	LAB Gruppen; LAB 300; N° 970-967
Equalizer	Sony, SRP-E100; N° 400238
Calibrator	Brüel & Kjær 4231; N° 2061476
Atmospheric conditions meter	Ahlborn Almemo 2590-3S; N° H09121017

Uncertainty in the measurement of atmospheric conditions:	
Air temperature	±0,5°C
Air humidity	±5%
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:

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

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:

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

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.

Reverberation time measurements of the empty room and of the room with the test specimen installed are carried out consecutively.

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: B2018-27-M542

Test date: 10th July, 2018

Test specimen: Configuration of panels *ISINAC ILUCS ADH.*

Configuration: Mounting type A according to Annex B of EN ISO 354:2003.



Area, S , test: 12.08 m²

Volume of reverberation room: 209.6 m³

t_1 : 21,7 °C

HR₁: 64 %

P₁: 961 mbar

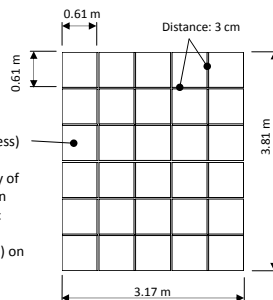
t_2 : 21,9 °C

HR₂: 65 %

P₂: 959 mbar

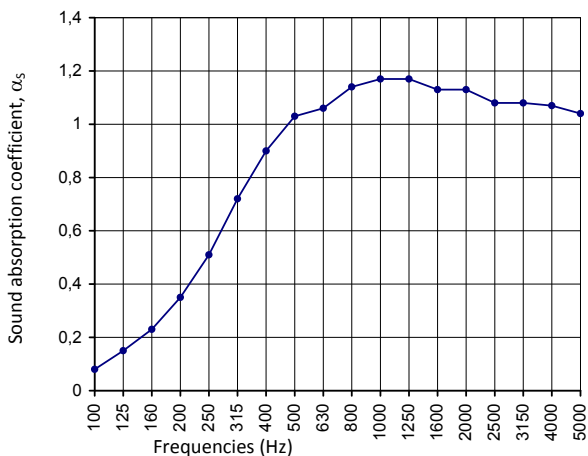
1. Empty room

2. Room with the test specimen



Panel (40 mm of nominal thickness)
composed of: Basotect open cell
melamine foam (nominal density of
9 kg/m³) with 120 gr. adhesive on
the hidden face + ILUCS Fabric
(100% Trevira CS polyester &
nominal grammage of 265 gr/m²) on
face-side and edges.

f (Hz)	T ₁	T ₂	α_s	α_p
100	9.26	7.36	0.08	0.15
125	8.39	5.82	0.15	
160	9.04	5.17	0.23	
200	9.63	4.36	0.35	
250	9.61	3.49	0.51	0.55
315	9.03	2.71	0.72	
400	8.82	2.29	0.90	
500	9.12	2.08	1.03	
630	8.73	2.02	1.06	1.00
800	8.39	1.89	1.14	
1000	7.82	1.82	1.17	
1250	7.00	1.78	1.17	
1600	6.34	1.77	1.13	1.00
2000	5.54	1.71	1.13	
2500	4.75	1.67	1.08	
3150	3.92	1.56	1.08	
4000	3.21	1.44	1.07	1.00
5000	2.44	1.28	1.04	



Evaluation according to EN ISO 11654:1997:

Weighted sound absorption coefficient: $\alpha_w = 0.85$ (H)

Evaluation based on laboratory measurement obtained by an engineering method.

