TEST REPORT No. 110259-8

CLIENT:	**ISINAC ACOUSTIC WORLD, S.L.** Av. de Ramón Nieto, 125-Bajo 36205 VIGO
AIM:	**Measurement of sound absorption in laboratory**
STANDARD:	**EN ISO 354:2003**
TEST SPECIMEN:	**Configuration of panels *ISINAC ILUCS+PX* with a separation of 400 mm from a surface**
ISSUE DATE:	**27/05/2024**

Technical Consultant
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LAB_SERVICES

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1. TEST SPECIMEN DESCRIPTION

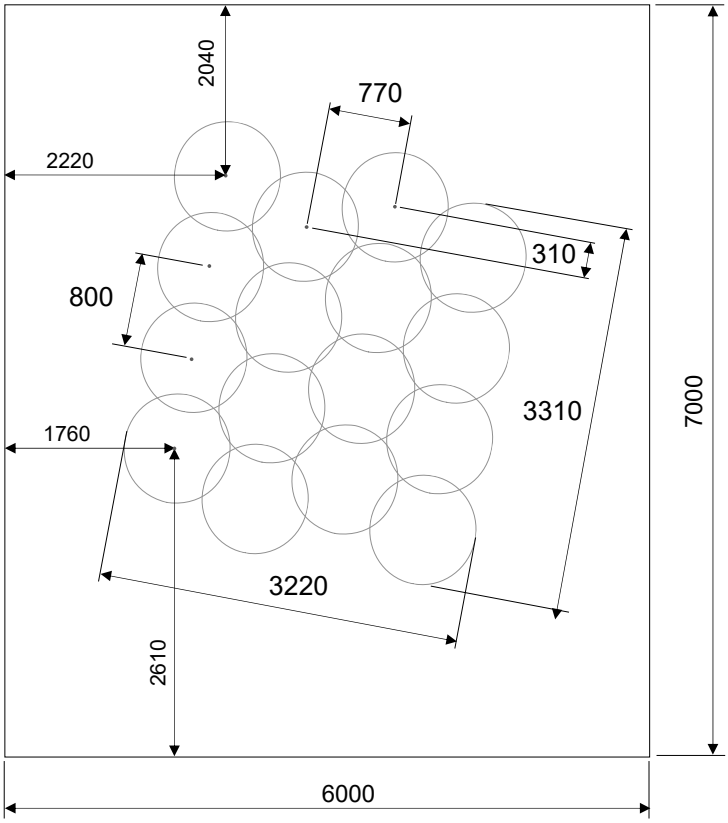
The test specimen consists of a configuration of panels separated from a surface, as detailed below, according to the information supplied by the client.

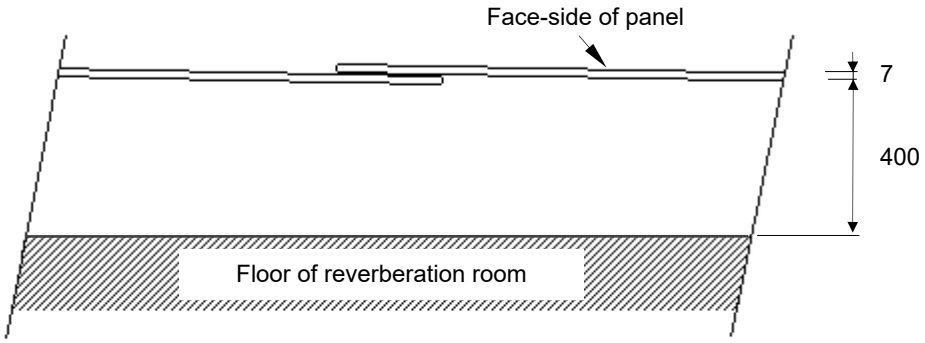
Description of the panel:

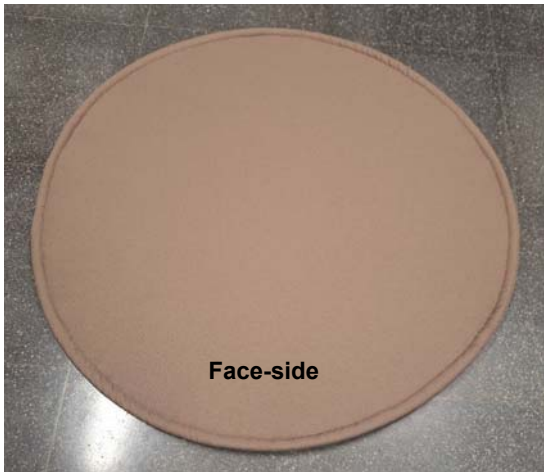
Reference:	***ISINAC ILUCS+PX***
Composition:	ILUCS fabric (100% Polyester Trevira CS; ~1 mm thick & 265 gr/m^2) on face and hidden side, with PX (non-woven fabric 100% carbon fiber, 5 mm thick and 500 gr/m^2) inside
Nominal dimensions:	91 mm diameter and & 7 mm thick

Arrangement of the test specimen:

The panels are placed at 400 mm above the floor of the test room, with butt joint between them, hidden face oriented towards the floor of the test room and covering a surface of 10,66 m^2, according to the following sketches:







Photos of panels

Photos of mounting of test specimen

Installation of the test specimen in the test room: Panels placed over perimeter and central steel profiles and metallic threads subject to the profiles.

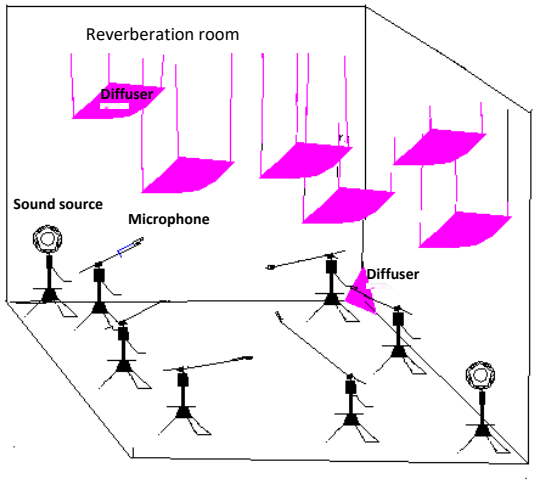
Manufacturer of panels: ISINAC ACOUSTIC WORLD, S.L.

Panels selected and delivered by: ISINAC ACOUSTIC WORLD, S.L.

Mounting performed by: TECNALIA

2. LABORATORY TEST FACILITY

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 (between 1 and 1,2 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 reverberation room

3. EQUIPMENT AND TEST CONDITIONS

Equipment

Microphones	Brüel&Kjær 4943; Serial No. 3188436	Brüel&Kjær 4943; Serial No. 3188435
Preamplifiers	Brüel&Kjær 2669; Serial No. 1948764	Brüel&Kjær 2669; Serial No. 2025844
Analyzer	Nor850-MF1; Serial No. 8501186	
Sound source	Brüel&Kjær 4296; Serial No. 2071428	
Amplifier	LAB 300; Serial No. 970-967	
Equalizer	Sony, SRP-E100; Serial No. 400238	
Calibrator	Brüel & Kjær 4231; Serial No. 2061476	
Environmental conditions meter	Rotronic BL-1D; Serial No. A21050028	

Environmental conditions:	Empty room	Room with test specimen	Uncertainty
Air temperature (ºC)	19,5	19,6	±0,5
Relative humidity (%)	40	51	±4
Static pressure (mbar)	960	962	±2

4. TEST PROCEDURE AND EVALUATION

The sound absorption coefficient, α_s, is calculated for the one-third-octave frequency band from 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 (m^2)

S: Area covered by test specimen (m^2)

The equivalent sound absorption area of test specimen, A_T, is calculated according to the 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 empty reverberation room (m^3)

C_1: Propagation speed of sound in air in empty reverberation room (m/s)

C_2: Propagation speed of sound in air in reverberation room with test specimen (m/s)

T_1: Reverberation time of empty reverberation room (s)

T_2: Reverberation time of reverberation room with test specimen (s)

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 measurement is performed using the interrupted noise method and is obtained by arithmetic average of measurements at 2 source positions and 6 fixed microphone positions for each source position.

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:

- Sound absorption coefficient, α_S, per one-third octave frequency bands from 100 to 5000 Hz.
- The following parameters obtained according to standard EN ISO 11654:1997, from the sound absorption coefficient α_S:
    - Practical sound absorption coefficient, α_p, in octave frequency bands from 125 to 4000 Hz
    - Weighted sound absorption coefficient, α_w
    - Shape indicators: L.M.H.

The intermediate data obtained in the test are:

f (Hz)	T_1	T_2	A_T
100	8,57	6,70	1,1
125	7,50	4,66	2,8
160	8,52	4,13	4,2
200	9,68	3,56	6,0
250	9,26	3,21	6,9
315	8,31	2,84	7,9
400	8,71	3,03	7,3
500	9,00	3,20	6,8
630	8,58	2,87	7,8

f (Hz)	T_1	T_2	A_T
800	8,11	2,59	8,9
1000	7,45	2,50	9,0
1250	6,81	2,27	10,0
1600	5,95	2,13	10,3
2000	5,07	1,94	11,0
2500	4,12	1,76	11,5
3150	3,25	1,55	12,3
4000	2,51	1,38	12,5
5000	1,78	1,17	12,2

Sound Absorption according to EN ISO 354:2003
Laboratory measurements

CLIENT: **ISINAC ACOUSTIC WORLD, S.L.**

TEST DATE: 09/05/2024

RESULT No.: 110259-8

TEST SPECIMEN:

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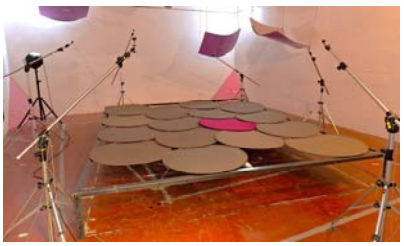
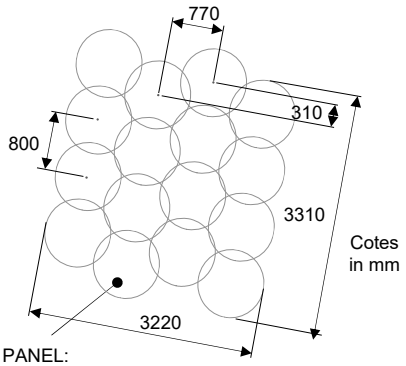


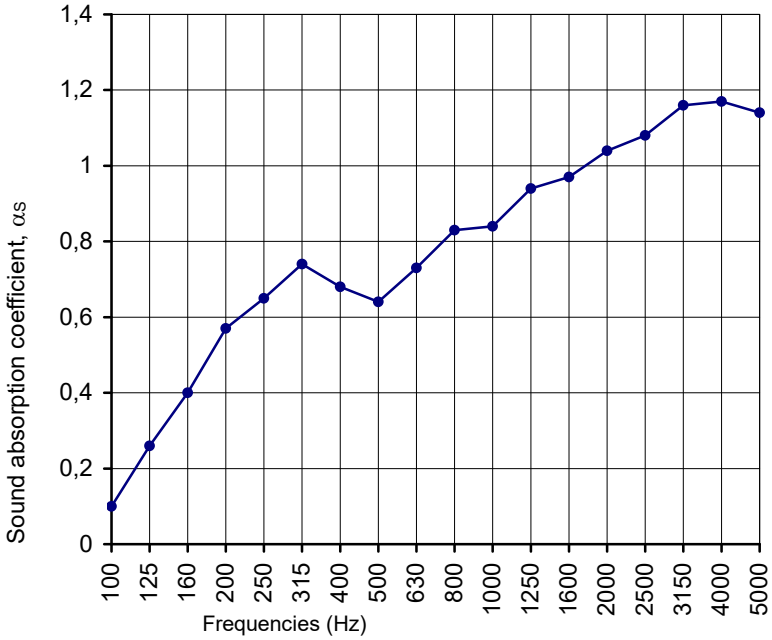


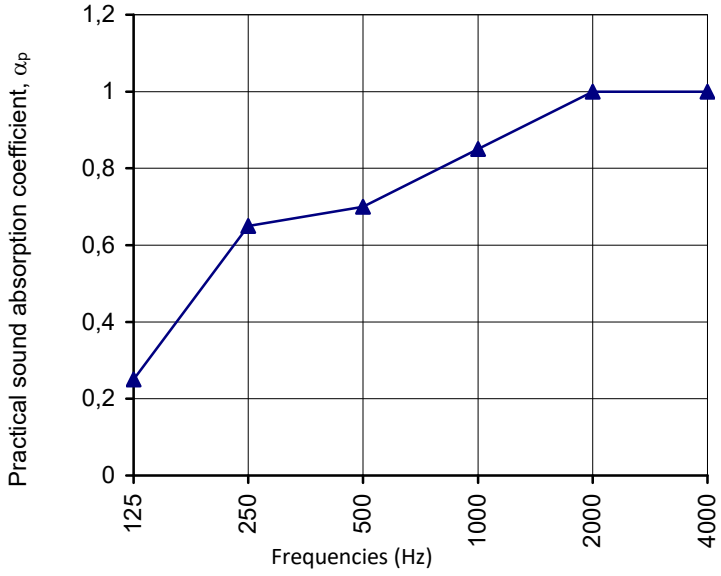
PANEL:
ILUCS fabric (100% Polyester Trevira CS & 265 gr/m^2) on face and hidden side, with PX (non-woven fabric 100% carbon fiber, 5 mm thick and 500 gr/m^2) inside

Area, S, test: 10,66 m^2
Reverberation room volume: 209,6 m^3

f (Hz)	α_s	α_p
100	0,10	0,25
125	0,26	
160	0,40	
200	0,57	0,65
250	0,65	
315	0,74	
400	0,68	0,70
500	0,64	
630	0,73	
800	0,83	0,85
1000	0,84	
1250	0,94	
1600	0,97	1,00
2000	1,04	
2500	1,08	
3150	1,16	1,00
4000	1,17	
5000	1,14	

Weighted sound absorption coefficient according to EN ISO 11654:1997
α_w = 0,80 (H)





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