

TEST REPORT No. B2023-LACUS-IN-195-1

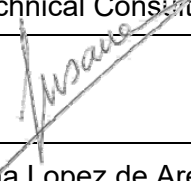
CLIENT: **ISINAC ACOUSTIC WORLD, S.L.**
Calle López de Neira 3, 3º - Oficina 301
36203 VIGO

AIM: **Laboratory measurement of sound absorption**

STANDARD: **EN ISO 354:2003**

TEST SPECIMEN: **Configuration of panels *ISINAC LINEAR IZZER***

ISSUE DATE: **21/02/2023**

Technical Consultant

Susana Lopez de Aretxaga



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- The results of the current report concern only and exclusively the test specimen.
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- Uncertainty related to the tests is available to the customer, if required.
- TECNALIA is not responsible for the information provided by the client.

1. TEST SPECIMEN DESCRIPTION

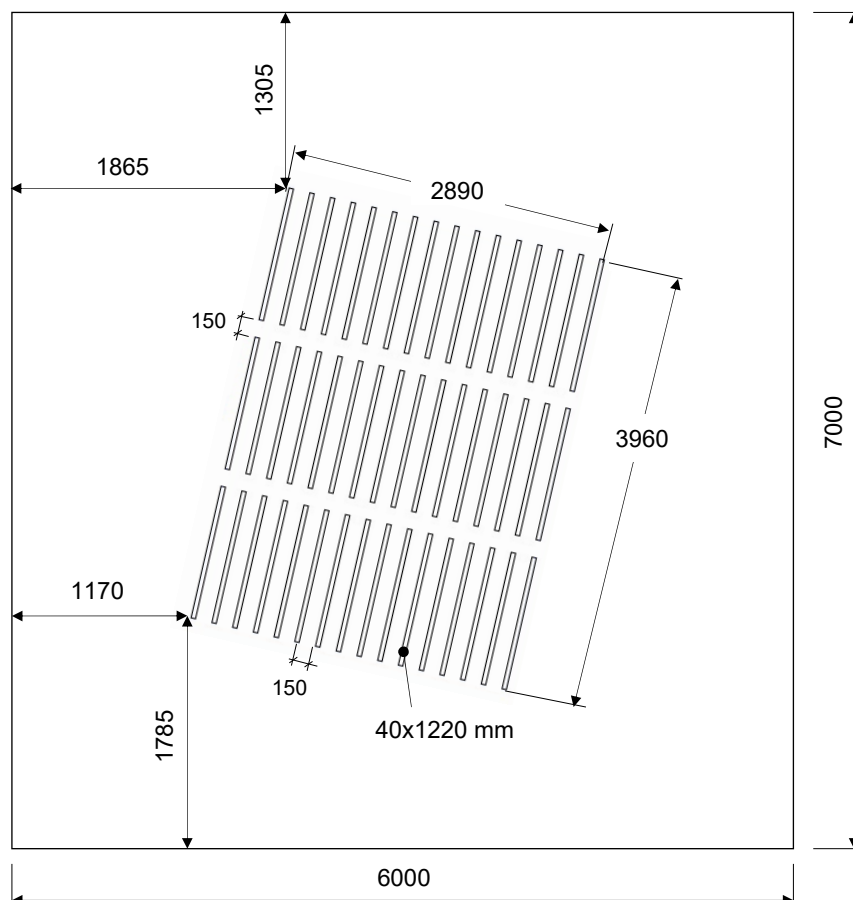
The test specimen consists of a configuration of panels, as detailed below according to the information provided by the client:

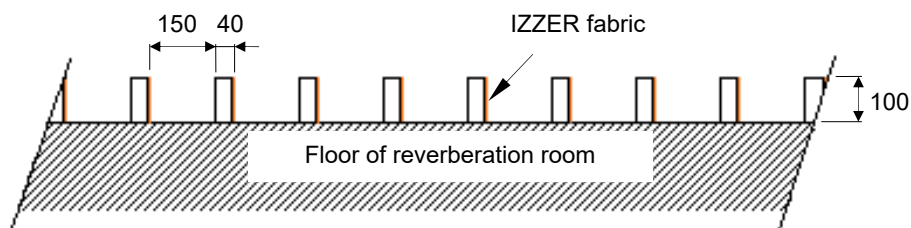
Description of the panel:

Reference:	ISINAC LINEAR IZZER
Composition:	open cell foam (9 kg/m ³ nominal density), with adhesive on the thickness face and IZZER fabric cover (100% Wool; ~2 mm thick & 460 gr/m ²) on one edge
Nominal dimensions:	100 mm high & 40x1220 mm

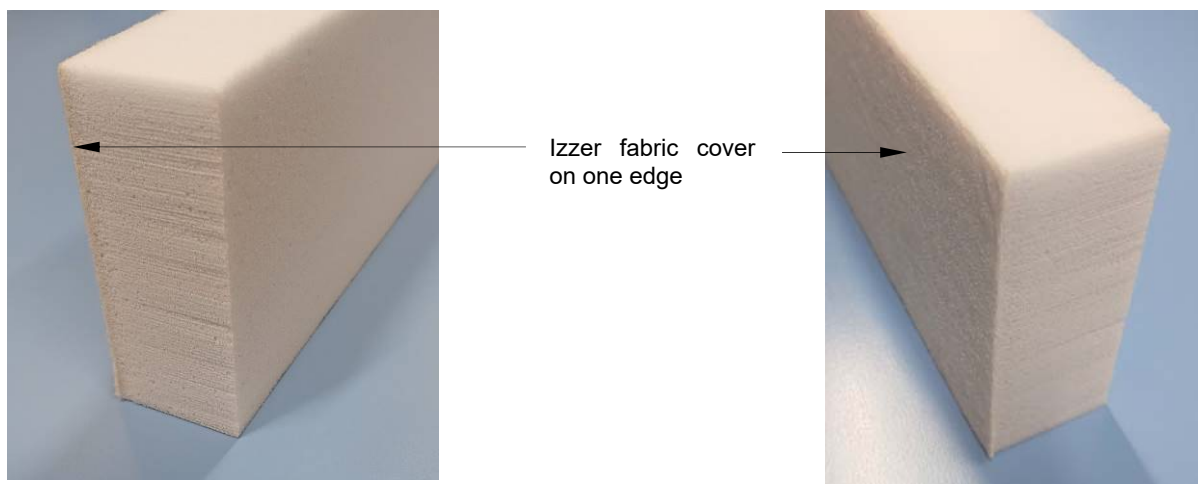
Arrangement of the test specimen:

The panels are placed on the floor of the reverberation room, with a distance of 150 mm between them, with the adhesive face against the floor of the test room, IZZER fabric of panels to the same side and covering a surface of 11,44 m², according to the following sketches:





Arrangement of the test specimen (B2023-195-M951). Cotes in mm



Photos of panel (visible faces)



Photos of test specimen

Manufacturer of panels: Client

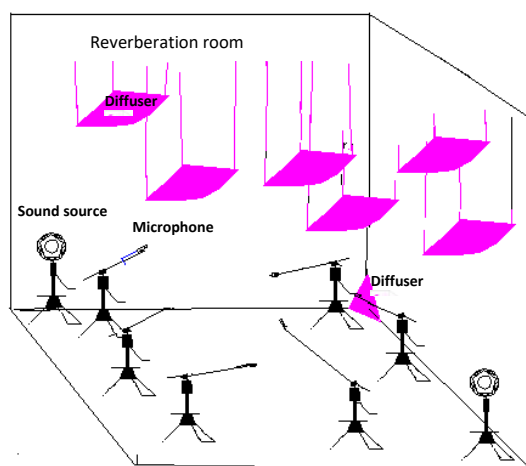
Panels selected and delivered by: Client

Mounting performed by: Tecnalia

Date of end of mounting: 19th January 2023

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.



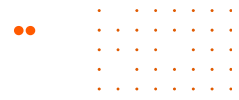
Sketch of the reverberation room

3. EQUIPMENT AND TEST CONDITIONS

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. 2061477	
Atmospheric conditions meter	Rotronic BL-1D; Serial No. A21050028	

Atmospheric conditions:	Empty room	Room with test specimen	Uncertainty
Air temperature (°C)	16,8	16,6	±0,5
Relative humidity (%)	50	52	±4
Static pressure (mbar)	955	961	±2



4. TEST PROCEDURE AND EVALUATION

The sound absorption coefficient, α_s , for the one-third octave band from 100 Hz to 5 kHz is obtained according to EN ISO 354:2003 using the following formula:

$$\alpha_s = A_T / S$$

A_T : Equivalent sound absorption area of test specimen, in m^2

S : Area covered by the test specimen, in m^2

The equivalent sound absorption area of the 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 installed (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 for the one-third-octave frequency bands between 100 Hz and 5 kHz is performed using the interrupted noise method and is obtained by the 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, in table and graph.
- 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	8,25	6,73	0,9
125	8,34	5,85	1,7
160	8,92	6,03	1,8
200	9,61	5,56	2,6
250	9,52	5,14	3,0
315	8,45	4,27	3,9
400	8,34	3,58	5,4
500	9,09	3,15	7,0
630	8,75	2,78	8,4
800	8,16	2,55	9,2
1000	7,59	2,41	9,7
1250	7,01	2,37	9,5
1600	6,22	2,32	9,2
2000	5,25	2,13	9,5
2500	4,33	1,96	9,6
3150	3,37	1,75	9,4
4000	2,62	1,54	9,3
5000	1,93	1,29	9,1

Sound absorption according to EN ISO 354:2003 Laboratory measurements

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

TEST DATE: 20/01/2023

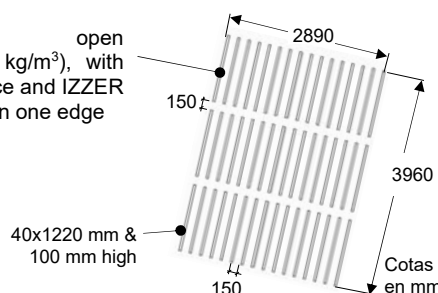
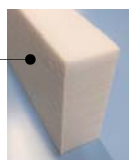
RESULT No.: B2023-195-M951

TEST SPECIMEN: Configuration of panels **ISINAC LINEAR IZZER**



Panel composed of open cell foam (9 kg/m³), with adhesive on thickness face and IZZER fabric cover (460 gr/m²) on one edge

IZZER fabric



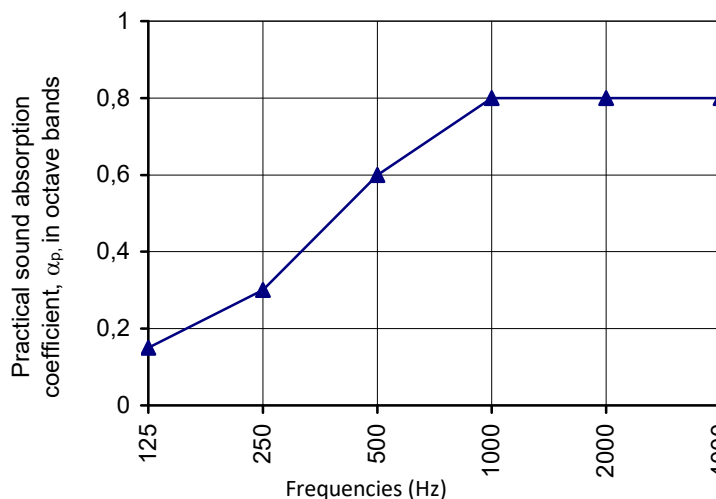
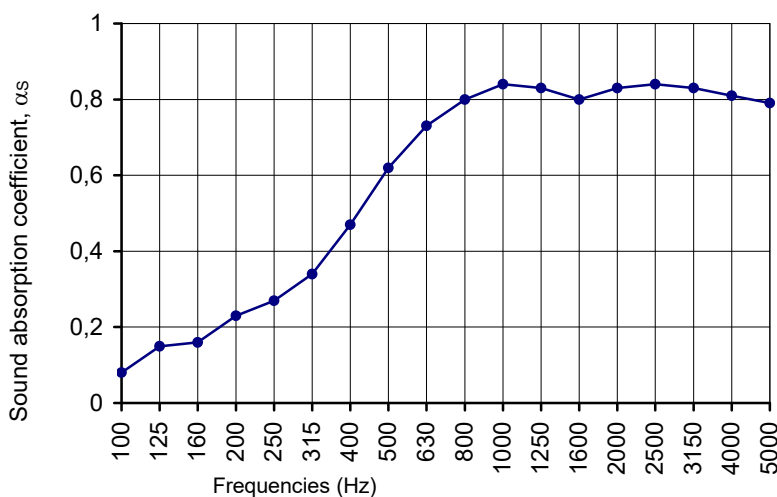
Area, S, test: 11,44 m²

Reverberation room volume: 209,6 m³

f (Hz)	α_s	α_p
100	0,08	
125	0,15	0,15
160	0,16	
200	0,23	
250	0,27	0,30
315	0,34	
400	0,47	
500	0,62	0,60
630	0,73	
800	0,80	
1000	0,84	0,80
1250	0,83	
1600	0,80	
2000	0,83	0,80
2500	0,84	
3150	0,83	
4000	0,81	0,80
5000	0,79	

Weighted sound absorption
coefficient according to
EN ISO 11654:1997

$\alpha_w = 0,60$ (H)



Evaluation based on laboratory measurement obtained by an engineering method