TEST REPORT No. B2023-LACUS-IN-195-3

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:	***ISINAC ISTORE IZZER* roller blind, with unrolled arrangement and 100 mm of distance to the wall**
ISSUE DATE:	**21/02/2023**

Technical Consultant
Susana Lopez de Aretxaga

LAB_SERVICES

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- The results of the current report concern only and exclusively the test specimen.
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1. TEST SPECIMEN DESCRIPTION

The test specimen consists of a roller blind separated from the wall, with the following description and test arrangement, according to the information provided by the client:

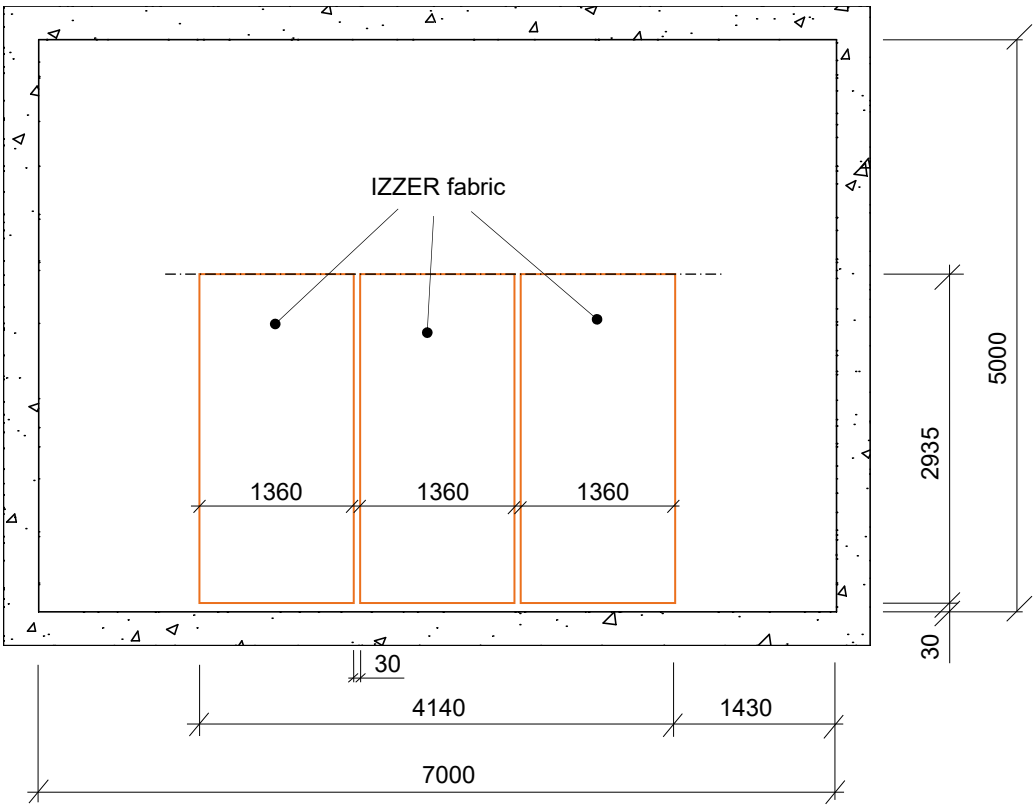
Description of the roller blind:

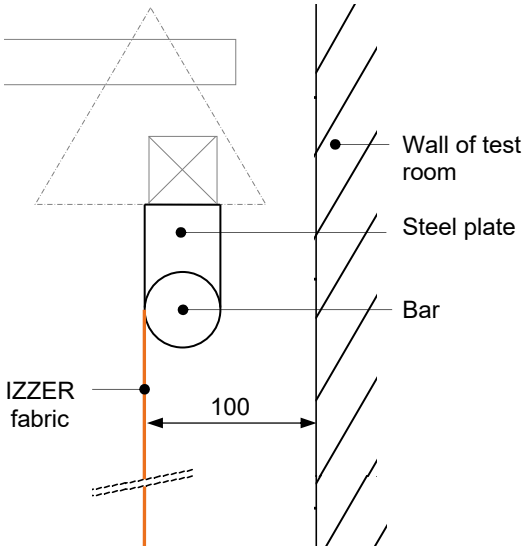
Reference:	***ISINAC ISTORE IZZER***
Composition:	Roller IZZER fabric (100% Wool; ~2 mm thick & 460 gr/m^2)

Photo of roller blind

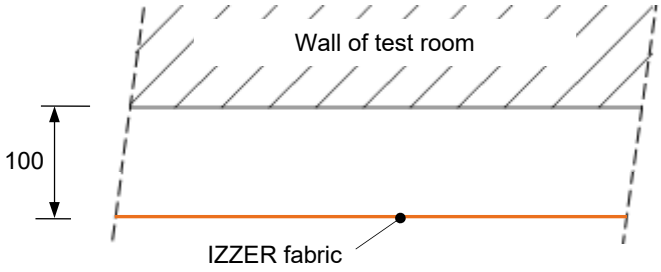
Arrangement of the test specimen:

- Unrolled arrangement.
- Dimensions: 4140 mm wide x 2935 mm high = 12,15 m^2.
- Test specimen installed parallel to one of the walls of the reverberation room, at a distance of 100 mm, without perimeter frame. Mounting type G-100 according to Annex B of EN ISO 354:2003.
- 3 blinds installed, each one hung by means of a steel plate placed at the ends of its bar, with plates between blinds butt to each other. Plates mechanically fixed to a 40x40 mm wooden strip placed on a steel structure (ø16 mm bars with 135 mm between axes) supported at the ends by 25x25 mm tubular steel profile.



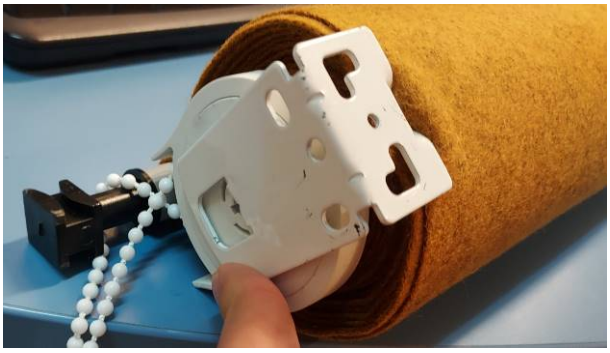


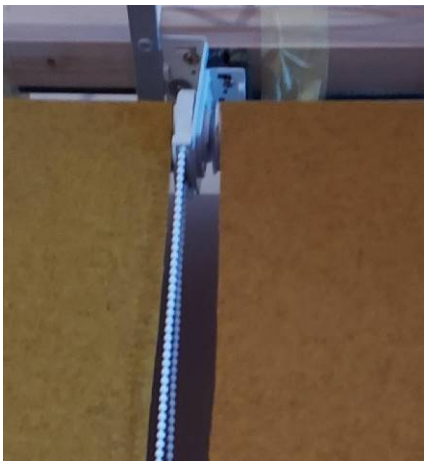
Vertical section



Horizontal section

Arrangement of the test specimen (B2023-195-M953). Cotes in mm





Photos of test specimen

Manufacturer: Client

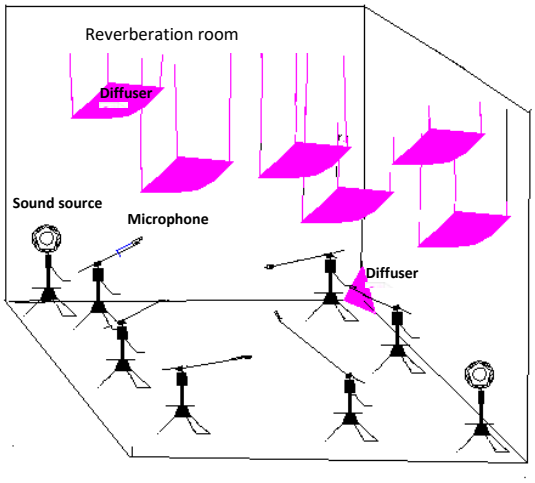
Material selected and delivered by: Client

Mounting performed by: Tecnalia

Date of end of mounting: 26th 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 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 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 (ºC)	16,6	16,1	±0,5
Relative humidity (%)	48	51	±4
Static pressure (mbar)	961	960	±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	8,07	7,28	0,5
125	7,80	6,62	0,8
160	8,33	6,71	1,0
200	8,60	6,05	1,7
250	8,87	5,63	2,2
315	7,78	4,28	3,6
400	7,38	3,65	4,7
500	7,80	3,23	6,2
630	7,15	2,78	7,5
800	6,63	2,48	8,6
1000	6,44	2,34	9,3
1250	5,95	2,26	9,4
1600	5,39	2,39	8,0
2000	4,62	2,50	6,3
2500	3,86	2,10	7,5
3150	3,05	1,79	8,1
4000	2,39	1,56	7,8
5000	1,76	1,26	8,0

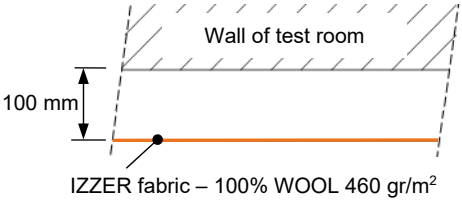
Sound absorption according to EN ISO 354:2003
Laboratory measurements

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

TEST DATE: 27th January 2023

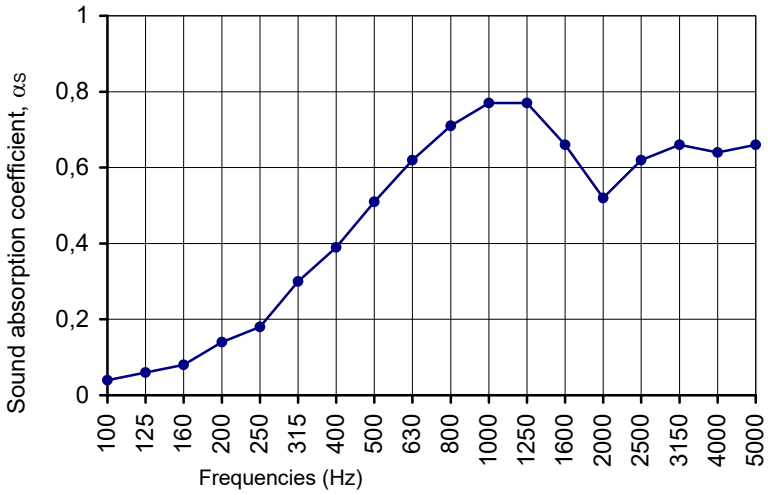
RESULT No.: B2023-195-M953

TEST SPECIMEN: ***ISINAC ISTORE IZZER*** **roller blind, with unrolled arrangement and 100 mm of distance to the wall**

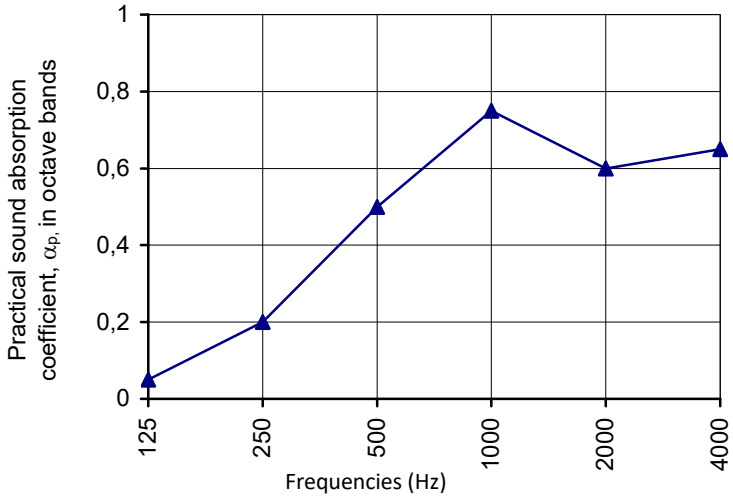


Area, S, test: 12,15 m²
Reverberation room volume: 209,6 m³

f (Hz)	α_s	α_p
100	0,04	
125	0,06	0,05
160	0,08	
200	0,14	
250	0,18	0,20
315	0,30	
400	0,39	
500	0,51	0,50
630	0,62	
800	0,71	
1000	0,77	0,75
1250	0,77	
1600	0,66	
2000	0,52	0,60
2500	0,62	
3150	0,66	
4000	0,64	0,65
5000	0,66	



Weighted sound absorption coefficient according to EN ISO 11654:1997
α_w = 0,50 (MH)



Evaluation based on laboratory measurement obtained by an engineering method