



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

## Test Report Nº B2019-LACUS-IN-54 V

### Laboratory measurements of sound absorption

AKUSTIKA ARLOA kudeatzailea:  
ACOUSTICS AREA managed by:



**TEST SPECIMEN:** ISINAC CURTAIN, with folded arrangement and 200 mm of distance to the wall.

**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:** 14th May, 2019.

**Signature:**

Technical Consultant  
Susana Lopez de Aretxaga

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

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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



This document includes only and exclusively the tested specimen(s) and the moment and conditions in which those measurements were made.

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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 folded curtain separated from the wall, with the following description and test arrangement, according to the information provided by the applicant:

### Description of the curtain:



- a. Lucía CS fabric:  
100% Trevira CS polyester  
(1 mm & 265 gr/m<sup>2</sup>)
- b. Non-woven fabric in carbon  
(3 mm & 250 gr/m<sup>2</sup>)

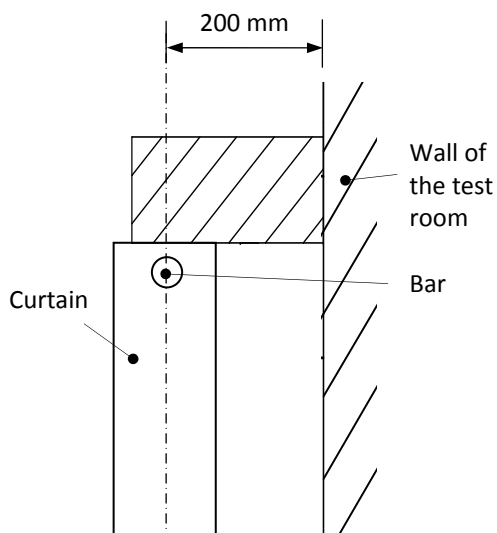
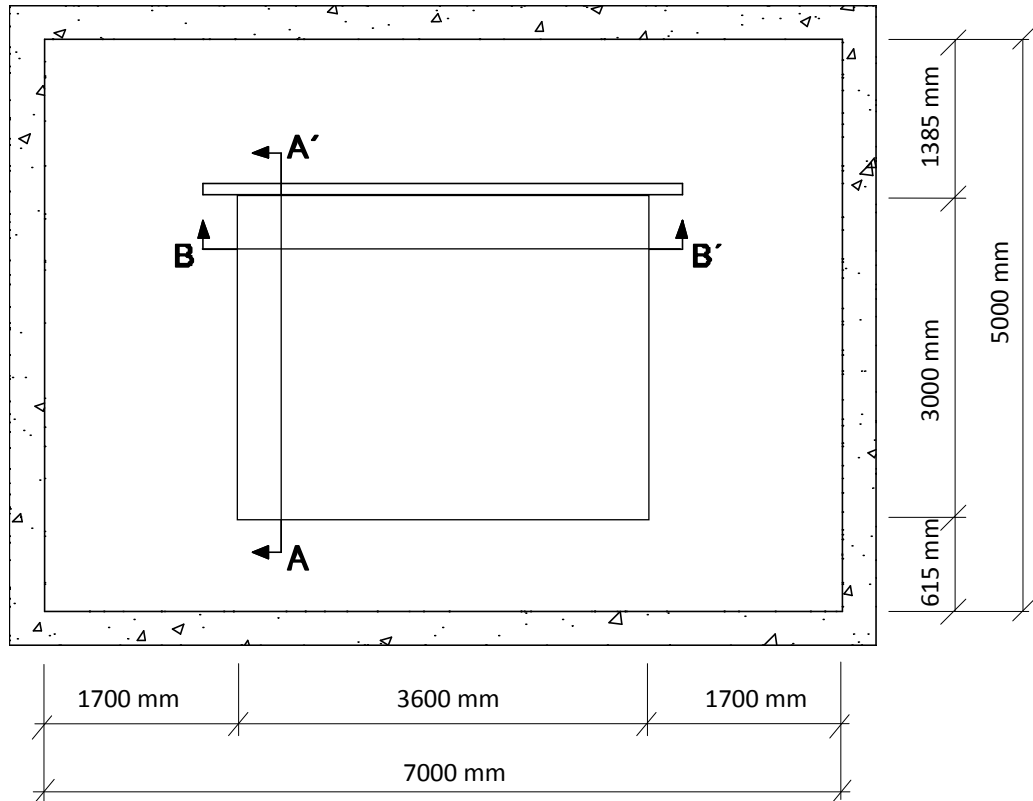
Each curtain panel is formed by 2 pieces (a+b) joined together by the sides and top.

Test specimen thickness: 8 mm.

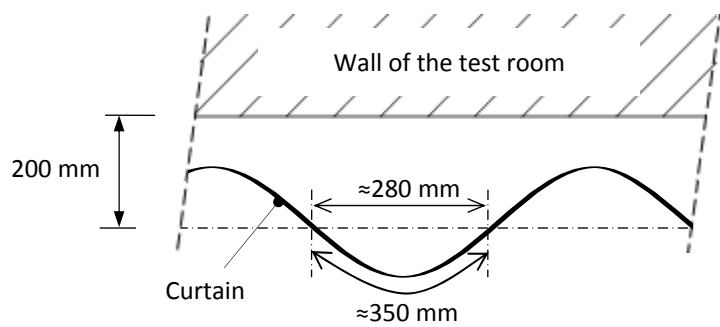
Manufacturer: ISINAC ACOUSTIC WORLD, S.L.

### Arrangement of the test specimen:

- Folded.
- Test specimen dimensions: 3600 mm wide x 3000 mm high = 10,8 m<sup>2</sup>
- The test specimen is made of 3 panels of 1550 mm wide x 3000 mm high each one joined by zipper, which form a curtain of exterior dimensions of 4650x3000 mm, which folding covers an area of 3600x3000 mm.
- The test specimen was mounted parallel to a wall of the reverberation room, with a distance between curtain and wall of 200 mm, without lateral frame. Mounting type G-200 according to Annex B of EN ISO 354:2003.
- The curtain was hanged from a wooden bar of Ø40 mm, fixed to a wooden beam of 230 mm wide x 100 mm high.

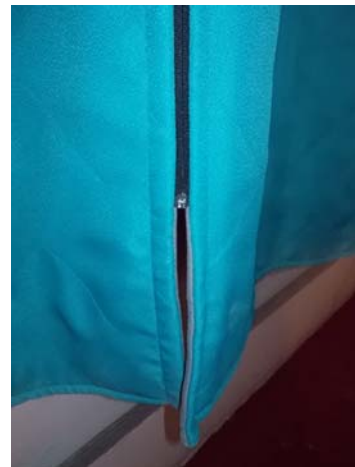


**Section AA'**



**Section BB'**

**Arrangement of the test specimen (B2019-54-M615)**



**Photos of assembly of test specimen**

Material selected and delivered by: applicant

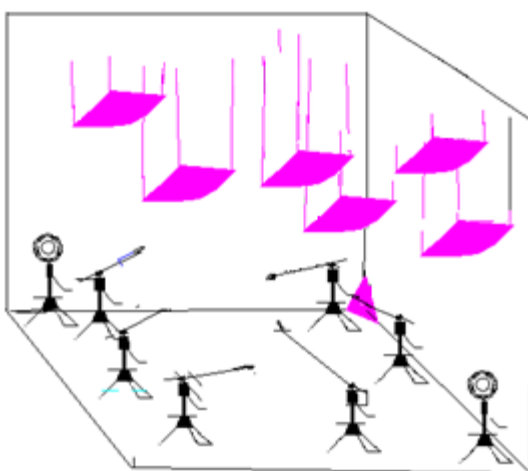
Assembly performed by: Tecnalia and Construcciones J.L. Iglesias

Assembly finished on: 8th May, 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<sup>2</sup> (walls, floor and ceiling). The sound field diffusivity of the room is obtained by means of twenty diffusers (0.8 m<sup>2</sup> - 1 m<sup>2</sup>) 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; Serial Nº 2534064
Preamplifier	B&K 2669; Serial Nº 1948764
Sound source	B&K 4296; Serial Nº 2071428

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

Uncertainty in the measurement of atmospheric conditions	
Air temperature	±0,5 °C
Air humidity	±4 %
Atmospheric pressure	±2 mbar



#### 4. TEST PROCEDURE AND EVALUATION

The sound absorption coefficient,  $\alpha_s$ , 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 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.

$m_1, m_2$ : 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 sources positions and six fixed microphone positions. For each microphone and source position, the reverberation time is determined 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 reverberation room without ( $T_1$ ) and with test specimen ( $T_2$ ).
- Sound absorption coefficient,  $\alpha_s$ , per one-third octave band from 100 Hz to 5000 Hz, in table and graph.
- The following parameters, calculated according to Standard EN ISO 11654:1997, from the sound absorption coefficient  $\alpha_s$  in frequency bands:
  - Practical sound absorption coefficient,  $\alpha_{pi}$ , per one-third octave band from 125 to 4000 Hz.
  - Weighted sound absorption coefficient,  $\alpha_w$ , plus its correspondent classification. Uncertainty associated to the global index  $\alpha_w$  is  $U=\pm 0,05\text{dB}$ , which corresponds to the expanded uncertainty with coverage factor  $k\approx 2$ .
- 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-M615

**Test date:** 8th May, 2019

**Test specimen:** ISINAC CURTAIN.

Each curtain panel is formed by 2 pieces (a+b) joined together by the sides and top.

**Test arrangement:** Folded arrangement. Type G-200 mounting (200 mm of distance to the wall) according to EN ISO 354:2003.

Area, S, test: 10.8 m<sup>2</sup>

Reverberation room volume: 209.6 m<sup>3</sup>

t<sub>1</sub> : 20.2 °C

HR<sub>1</sub> : 47 %

P<sub>1</sub>: 955 mbar

t<sub>2</sub> : 20.9 °C

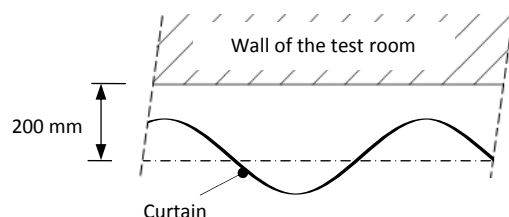
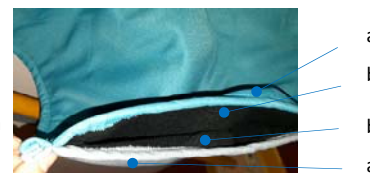
HR<sub>2</sub> : 51 %

P<sub>2</sub>: 952 mbar

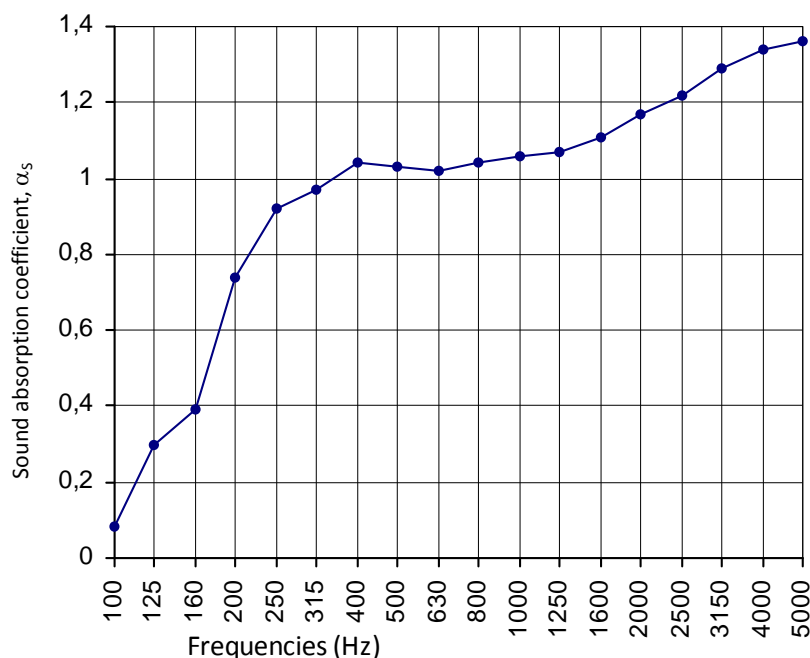
1. Empty room
2. Room with test specimen



- a- Lucía CS fabric:  
100% Trevira CS polyester  
(1 mm & 265 gr/m<sup>2</sup>)
- b- Non-woven fabric in carbon  
(3 mm & 250 gr/m<sup>2</sup>)



f (Hz)	T <sub>1</sub>	T <sub>2</sub>	α <sub>s</sub>	α <sub>p</sub>
100	8.49	6.98	<b>0.08</b>	<b>0.25</b>
125	8.45	4.66	<b>0.30</b>	
160	8.83	4.19	<b>0.39</b>	<b>0.90</b>
200	9.17	2.90	<b>0.74</b>	
250	9.10	2.48	<b>0.92</b>	
315	8.55	2.33	<b>0.97</b>	<b>1.00</b>
400	8.61	2.23	<b>1.04</b>	
500	8.77	2.25	<b>1.03</b>	<b>1.00</b>
630	8.49	2.24	<b>1.02</b>	
800	8.00	2.18	<b>1.04</b>	<b>1.00</b>
1000	7.52	2.11	<b>1.06</b>	
1250	6.87	2.04	<b>1.07</b>	<b>1.00</b>
1600	6.15	1.93	<b>1.11</b>	
2000	5.26	1.78	<b>1.17</b>	<b>1.00</b>
2500	4.38	1.63	<b>1.22</b>	
3150	3.46	1.44	<b>1.29</b>	<b>1.00</b>
4000	2.72	1.28	<b>1.34</b>	
5000	2.04	1.11	<b>1.36</b>	



### Evaluation according to EN ISO 11654:1997

Weighted sound absorption coefficient:

**α<sub>w</sub> = 1,00**

Classification:

**A**

*Evaluation based on laboratory measurement obtained by an engineering method.*

