



INGURUMENA, LURRALDE PLANGINTZA

ETA ETXEBIZITZA SAILA

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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-83 III

Laboratory measurements of sound absorption

AKUSTIKA ARLOA kudeatzailea:

ACOUSTICS AREA managed by:

**TEST SPECIMEN:** ISINAC ELIPTIC Bass Trap (distributed in the corners).**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 November 2019**Signature:**

Technical Consultant

Susana Lopez de Aretxaga

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

Facilities where measurements are carried out under the scope of ENAC Nº4/LE456 accreditation belong to the Acoustics Area of the Building Quality Control Laboratory of the Basque Government, placed at Agirrelanda Street, 10, 01013 Vitoria – Gasteiz (Spain).

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: 7



This document includes only and exclusively the test specimen 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

Bass Trap, as detailed below according to the information provided by the applicant.

Description of the Bass Trap:

Reference:	ISINAC ELIPTIC
Size:	1230 mm high x 610 mm x 305 mm
Composition:	Frame: Birch plywood board of 15 mm and 9 mm thick. Inner material: - Open cell melamine foam 'Basotect' of 60-120 mm variable thickness and 9 kg/m³ nominal density. - Fire-resistant polyurethane foam of 25 kg/m³ and 20-80 mm variable thickness. External material: Lucia CS fabric (fire-resistant 100% Trevira CS polyester of 230 gr/m²) on the face side and edges.

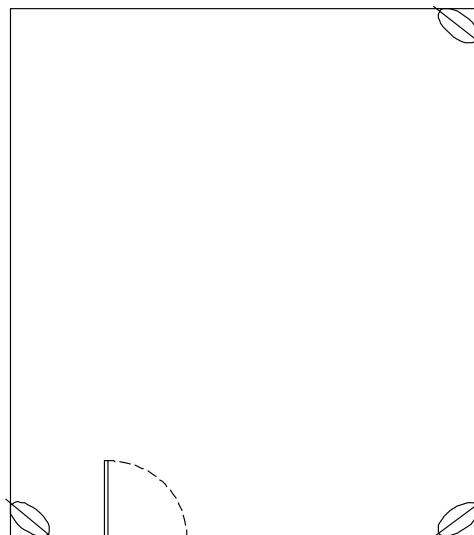


Photos of the Bass Trap (face side)



Arrangement of the test specimen:

The sound absorption provided by the Bass Trap, is determined using 3 samples, in their usual arrangement (standing vertically on the floor), and distributed in the corners of the reverberation room, according to the specifications given by the applicant.



Arrangement of the test specimen (B2019-83-M659)



Photo of the 3 samples in reverberation room

Manufacturer of the specimen: applicant

Panels selected and delivered by: applicant

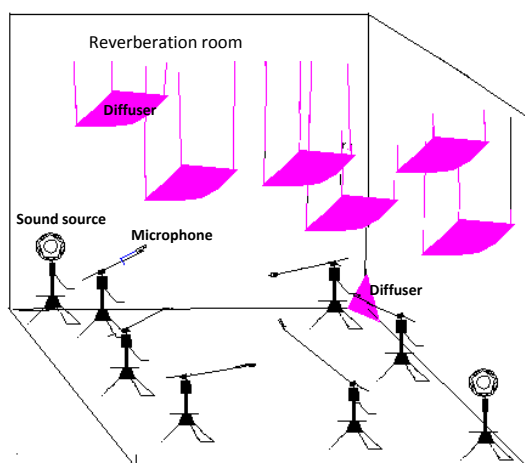
Mounting performed by: Tecnalía

Date of end of mounting: 7th November 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 (walls, floor and ceiling) of 211.8 m². 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 five 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. 30933386
Preamplifier	B&K 2669; Serial No. 2025844
Sound source	B&K 4296; Serial No. 2071428

	Control room
Analyzer	Nor850-MF1; Serial No. 8501186
Amplifier	LAB Gruppen; LAB 300; Serial No. 970-967
Equalizer	Sony, SRP-E100; Serial No. 400238
Calibrator	Brüel & Kjær 4231; Serial No. 2061476
Atmospheric conditions meter	Ahlborn 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 equivalent sound absorption area of an individual object, for the one-third-octave band from 100 Hz to 5 kHz, is calculated according to EN ISO 354:2003, using the following formula:

$$A_{obj} = \frac{A_T}{n}$$

A_T : Equivalent sound absorption area of test specimen, in square metres.

n : Number of objects used in the test.

The equivalent sound absorption area of the 'n' objects is calculated according to the following formula:

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

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.

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 object:

- The equivalent sound absorption area of the Bass trap, A_{obj} , for the one-third-octave bands from 100 Hz to 5 kHz and for octave bands from 125 to 4000 Hz, is featured in table and graph. The values in octave bands are calculated as an arithmetic mean of the values in the one-third-octave bands.

This table presents the intermediate values of the reverberation times: empty room (T_1) and room with objects (T_2):

f (Hz)	T_1	T_2
100	11.93	6.74
125	9.49	4.19
160	9.46	4.04
200	10.80	4.54
250	10.15	3.92
315	8.85	3.80
400	8.97	3.84
500	9.42	4.06
630	8.86	4.20
800	7.96	4.17
1000	7.28	4.02
1250	6.44	3.92
1600	5.75	3.67
2000	5.11	3.41
2500	4.32	3.05
3150	3.55	2.62
4000	2.85	2.23
5000	2.18	1.79

Additional information:

- Single object sound absorption coefficient in octave bands, α_{obj} , according to ISO 20189:2018:

$$\alpha_{obj} = A_{obj} / S$$

A_{obj} : Equivalent sound absorption area in octave bands of the object

S: Exposed surface area of the smallest cuboid that enfolds the object (2,44 m²)

This value could be used for the purpose of 3D models, in order to assign an absorption coefficient to the surfaces of the object and considering that the object has been tested under the same conditions in which the simulation is subsequently performed.

Sound absorption according to EN ISO 354:2003 Laboratory measurements

Applicant: ISINAC ACOUSTIC WORLD, S.L.

Test date: 08/11/2019

Test specimen: ISINAC ELIPTIC Bass Trap (distributed in the corners)

Result Nº: B2019-83-M659

Reverberation room volume: 209,6 m³

Number of used samples: 3 (1230 mm high x 610 mm x 305 mm)

Arrangement: samples in the corners of the reverberation room

t₁: 19,8 °C

t₂: 19,7 °C

HR₁: 58 %

HR₂: 55 %

P₁: 950 mbar

P₂: 950 mbar

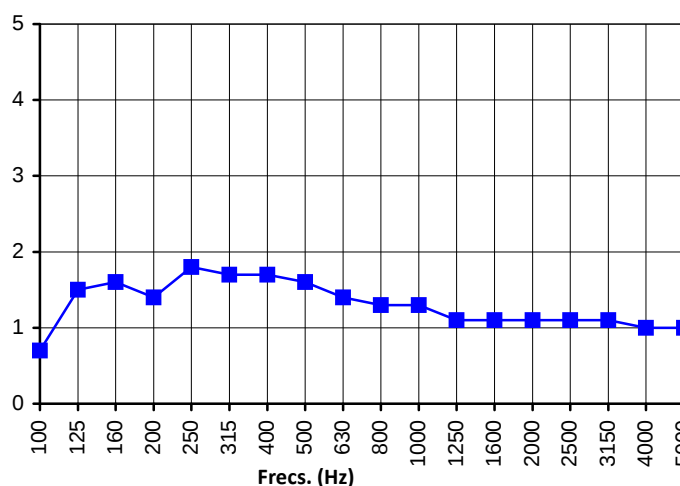
1. Empty room

2. Room with test specimen



f (Hz)	A _{obj} (m ²)	
	1/3 octave band	Octave band
100	0.7	1.3
125	1.5	
160	1.6	
200	1.4	1.6
250	1.8	
315	1.7	
400	1.7	1.6
500	1.6	
630	1.4	
800	1.3	1.2
1000	1.3	
1250	1.1	
1600	1.1	1.1
2000	1.1	
2500	1.1	
3150	1.1	1.0
4000	1.0	
5000	1.0	

Object's equivalent sound absorption area, A_{obj} (m²)



Evaluation based on laboratory measurement
obtained by an engineering method

Additional information: Absorption coefficients calculated for the surface of the object:

f (Hz)	125	250	500	1000	2000	4000
α _{obj}	0.5	0.7	0.7	0.5	0.5	0.4