ESSAY REPORT

Report number:	23/32300684
Date of issue:	January 24, 2023
Petitioner essay:	FINANCIERA MADERERA, SA (FINSA) Highway N-550, km 57 15707 – Santiago de Compostela (A Coruña)

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Essay requested:	Measurement of acoustic absorption in a reverberant chamber according to with the UNE-EN ISO 354:2004 standard.
Tested sample:	Sample of wall/ceiling cladding composed of panel with commercial reference FIBRACOLOUR BLACK E.Z.SLOTTED NAT and 50 mm plenum with rock wool inside.
Test date:	01/18/2023
Test performance:	Xavier Roviralta

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ENAC
ENSAYO
ISO 17025
Nº9 / LE766

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1.- OBJECTIVE OF THE TEST

Measurement of acoustic absorption in a reverberant chamber, in accordance with the UNE-EN ISO standard 354:2004, from a panel composite wall/ceiling cladding sample with reference commercialFIBRACOLOUR BLACK E.Z.SLOTTED NAT and 50 mm plenum with rock wool in its interior.

2.- MEASUREMENT EQUIPMENT

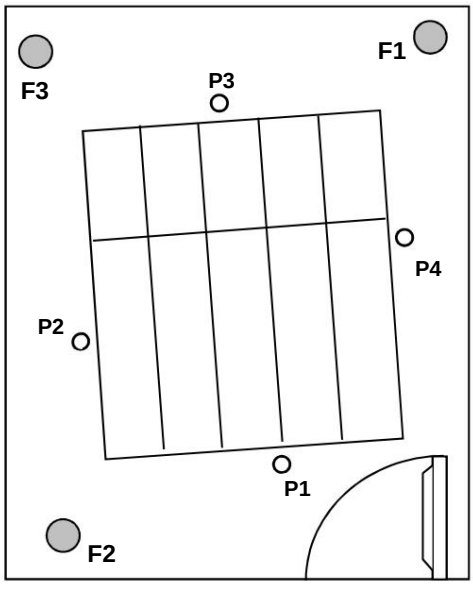
The equipment used to carry out the acoustic measurements is the following:

- Spectrum analyzer id no.: 170701 (Bruel&Kjaer mod. Pulse LAN-XI)
- Sound calibrator id no.: 171067 (Bruel&Kjaer mod. 4231)
- Diffuse field microphones id no.: 171213, 171214, 171315 and 170093 (Bruel&Kjaer mod. 4943)
- Omnidirectional noise sources ID no.: 103098 (AVM mod. DO12), 171216 and 171217 (CESVA mod. BP012)
- Noise generator ID no.: 103195 (Bruel&Kjaer mod. 1049)
- Power amplifier ID no.: 103097 (INTER mod. M700)
- Equalizer id no.: 170092 (INTER mod. EQ-9231) •

Thermohygrometer and barometer id no.: 171282 (PCE mod. THB-40) •

Flexometer id no.: 103095 (Stanley mod. Powerlock)

3.- MEASUREMENT PROCEDURE



Schematic sketch of test layout

Measurements are carried out in accordance with the test standard UNE-EN ISO 354:2004 "Acoustic absorption measurement in the a reverberant chamber . The test method is basically comparing the reverberation times of the room with the sample and without it. The evaluation of the results It is carried out in accordance with the UNE-EN ISO 11654:1998 standard.

4 microphone positions are defined around the sample (P1, P2, P3 and P4, schematically). The measurements are performed with the noise sources in positions F1, F2 and F3. The test is carried out by exciting the room with pink or white noise. With the measured reverberation times, the formula from section 4.3.

4.- DEFINITIONS AND CLASSIFICATION

4.1. Reverberation time. Time, in seconds, required for the pressure level noise decreases by 60 dB after the emission of the sound source stops.

4.2. Equivalent sound absorption area of an enclosure. Hypothetical area of a surface totally absorbent without diffraction effects that, if it were the only absorbing element in the enclosure, would have the same reverberation time as the enclosure considered.

4.3. Equivalent sound absorption area of the test sample, AT. Difference between the equivalent sound absorption areas of the reverberant chamber with and without the test sample. To obtain this parameter, the average reverberation time in the chamber is measured. reverberant with and without test sample. From these reverberation times, the equivalent sound absorption area AT by means of the Sabine equation:

$$A_T = 55.3V\left(\frac{1}{c_2 T_2} - \frac{1}{c_1 T_1}\right) - 4V(m_2 - m_1)$$

where:

- **c1 and c2 are the speed of sound propagation in air at temperatures t1 and t2;**
- **V is the volume, in cubic meters, of the empty reverberant chamber;**
- **T1 is the reverberation time, in seconds, of the empty reverberant chamber;**
- **T2 is the reverberation time, in seconds, of the reverberant chamber with the sample of rehearsal;**
- **m1 and m2 are the sound attenuation coefficients, in reciprocal meters, for the empty reverberant chamber and with the test sample, respectively. m is calculated in accordance with International Standard ISO 9613-1:1993 using the climatic conditions of the reverberant chamber during measurement.**

The value of m can be calculated from the attenuation coefficient, ÿ, used in the Standard International ISO 9613-1:1993 according to the formula:

$$m = \frac{\ddot{y}}{10\log(e)}$$

4.4. Sound absorption coefficient. In the case of samples that uniformly cover a surface (flat absorbers or a specific configuration of identical objects), the coefficient sound absorption is obtained by dividing AT by the area S of the treated surface

$$\ddot{y}_{Yes} = \frac{T\Theta_1}{Yes}$$

When the sample is composed of several identical objects, the result can be given as the equivalent sound absorption area A of each element, and is obtained by dividing AT by the number of objects, n:

$$To\ obj = \frac{T\Theta_1}{n}$$

4.5. Practical sound absorption coefficient, ÿp. Acoustic absorption coefficient value frequency dependent, based on measurements by one-third octave bands in accordance with the UNE-EN ISO 354:2004 standard, and calculated by octave bands according to the following formula:

$$\ddot{y}_{pi} = \frac{\ddot{y}_{1i} + \ddot{y}_{2i} + \ddot{y}_{3i}}{3}$$

where:

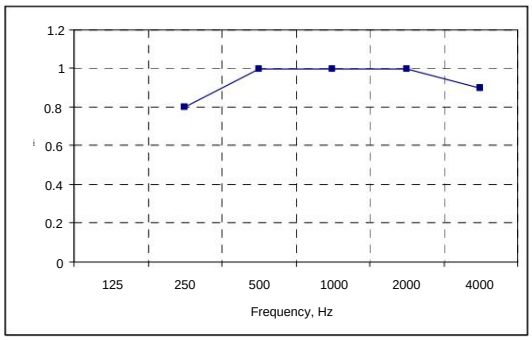
- **ÿpi is the practical sound absorption coefficient for octave band i**
- **ÿi1, ÿi2 and ÿi3, are the acoustic absorption coefficients of the third octave bands within the octave i**

The mean value is calculated to the second decimal place and the result is rounded in steps of 0.05 up to a maximum of ÿpi = 1.00 for rounded mean values > 1.00.

4.6. Weighted sound absorption coefficient, ÿW. Unique value independent of frequency, equal to the value of the reference curve at 500 Hz after shifting it, as shown indicated below, according to the procedure defined in the UNE-EN ISO 11654:1998 standard.

A translation of the reference curve is carried out in steps of 0.05 towards the value curve of the practical sound absorption coefficient, until the sum of the unfavorable deviations is less than or equal to 0.10. An unfavorable deviation occurs at a particular frequency when The measured value is less than the reference curve value. They should be taken into account only deviations in the unfavorable direction. The ÿ-weighted acoustic absorption is defined as the value of the reference curve once shifted to the frequency of 500 Hz. In the following table The original values of the reference curve are given:

Frequency (Hz)	Reference curve value
250	0.80
500	1.00
1000	1.00
2000	1.00
4000	0.90



4.7. Shape indicators, LMH Whenever a practical sound absorption coefficient ÿpi exceeds the value of the reference curve once shifted by 0.25 or more, one or more shape indicators must be added in parentheses.

If the excess absorption occurs at 250 Hz, the notation L is used. If the excess occurs at 500 Hz or 1 000 Hz, the notation M is used. If the excess occurs at 2 000 Hz or 4 000 Hz, used the H notation.

4.8. Classification of absorbents. The classification system given below is designed primarily for broadband applications. The single value, ÿW, is used to calculate the acoustic absorption class according to the following table (Table B.1 of Annex B, informative, from the UNE-EN ISO 11654:1998 standard):

Acoustic absorption class	ÿw
TO	0.90; 0.95; 1.00
b	0.80; 0.85
c	0.60; 0.65; 0.70; 0.75
d	0.30; 0.35; 0.40; 0.45; 0.50; 0.55
AND	0.15; 0.20; 0.25
Unclassified	0.00; 0.05; 0.10

5.- TEST UNCERTAINTY

The uncertainty associated with the test has been calculated and is available to the petitioner. The expanded uncertainty has been calculated as the standard measurement uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a probability of coverage of approximately 95%.

For the weighted sound absorption coefficient, ÿW, the calculated expanded uncertainty is U(ÿW)= ±0.07. For classification purposes consider U(ÿW)= ±0.10.

6.- DESCRIPTION OF THE TEST SAMPLE

The main characteristics of the test sample are indicated below. The references/models and the information indicated with (*) is provided by the test petitioner. LGAI Technological Center, SA is not responsible for the documentation and/or information provided. by the petitioner.

Applus sample number	**12261**
Maker	**FINANCIERA MADERERA, SA (FINSA)**
Model / Reference	**FIBRACOLOUR BLACK E.Z.SLOTTED NAT**
Delivered by	**FINANCIERA MADERERA, SA (FINSA)**
Reception date	**01/16/2023**
Type of test sample Wall/ceiling covering	
sample area, Yes	**10.97 m2 – 3000 x 3655 mm**
Sample thickness	**Nominal thickness: 19mm (*) / Total height with plenum: ÿ 69 mm**
Test sample composition	**Wall/ceiling covering composed of:** **- Dashboard FIBRACOLOUR BLACK E.Z.SLOTTED NAT** **- 50 mm plenum** **- Rock wool of 50 mm nominal thickness and 40 kg/m3 inside the plenum, in contact with the panel** **Panel description FIBRACOLOUR BLACK E.Z.SLOTTED NAT: (*)** **- Mass colored MDF board covered on both sides with 0.5 mm wood veneer and sanded. The exposed face of the board is slotted to make a decorative effect.** **- Nominal density: from 710 to 740 kg/m3** **Support structure: 25 x 50 mm (thickness x height) wooden slats** **Union between panels: end** **Sample consisting of 5 panels of 2440 x 600 mm and 5 panels of 1220 x 600 mm**
Test setup	**Type E-50 assembly according to UNE-EN ISO 354:2004 Annex B (50 mm air space under the sample).**
Perimeter frame	**Wooden strip measuring 70 x 35 mm (height x thickness). Frame sealed against the floor of the reverberant chamber with adhesive tape.**
Sample section	**See Figure 1**

Assembly of the sample (performed by/date)

Applus Laboratories – LGAI TC / 01/18/2023

Images 1 to 4 Details of the tested sample: **FIBRACOLOUR BLACK** **E.Z.SLOTTED NAT**

Images 5 to 7 Sample installation

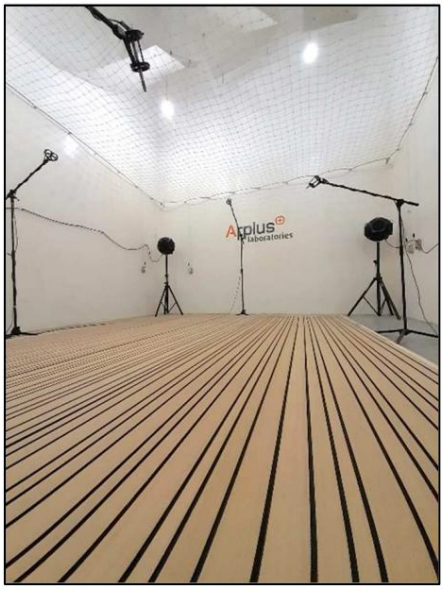


Image 8 Sample ready for testing

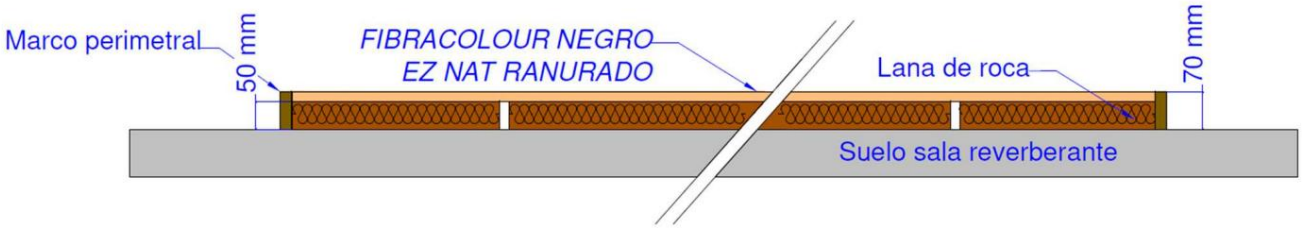


Figure 1 Sample section

7.- TEST CONDITIONS

Reverberant Room Features			
Shape:	parallelepiped	Total surface area (St):	238.1 m2
Dimensions: 7,835 × 4,956 × 6,271 m		Number of diffusers:	14
Volume (V):	243.5 m3	Diffuser dimensions:	1.5 m2

Environmental conditions of the reverberant room		
Room status:	Empty	With sample
Temperature:	19.1ºC	19.5ºC
Humidity:	42.9%	44.3%
Atmospheric pressure:	982.7 hPa	985.3 hPa

8.- REVERBERATION TIMES AND EQUIVALENT SOUND ABSORPTION AREA

The following table shows the reverberation times of the rehearsal room without the sample. and with the sample, as well as the calculated equivalent sound absorption areas.

Frequency (Hz)	Empty room reverberation time, T1 (s)	Reverberation time with sample, T2 (s)	Equivalent sound absorption area, AT (m^2)
100	15.87	6.62	3.5
125	11.22	6.15	2.9
160	10.13	6.41	23
200	11.60	7.69	1.7
250	12.36	8.16	1.6
315	11.27	8.51	1.1
400	10.78	8.65	0.9
500	10.58	8.71	0.8
630	10.04	8.42	0.7
800	9.53	7.97	0.8
1000	8.95	7.51	0.8
1250	7.96	6.52	1.1
1600	6.73	5.51	1.3
2000	5.69	4.72	1.5
2500	4.72	3.89	1.9
3150	3.80	3.20	2.2
4000	2.83	2.43	2.6
5000	2.16	1.93	2.7

9.- RESULTS

Measurement of acoustic absorption according to UNE-EN ISO 354:2004

Petitioner: FINANCIERA MADERERA, SA (FINSA)

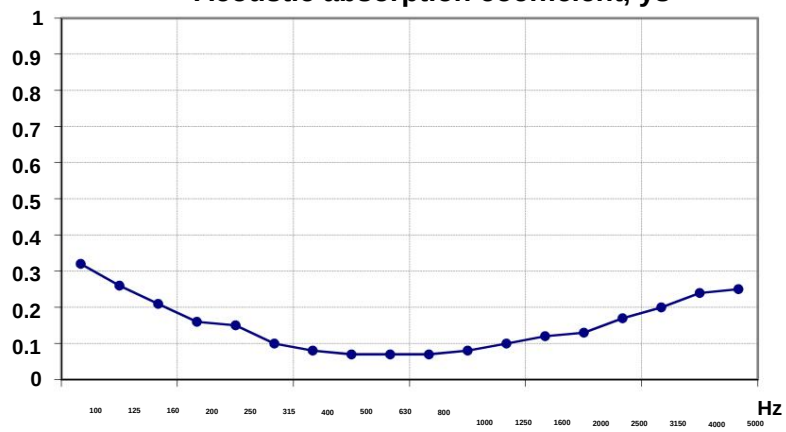
Tested sample:
Composite panel wall/ceiling cladding sample with commercial reference FIBRACOLOR BLACK E.Z. SLOTTED NAT and 50 mm plenum with rock wool inside.

Mounting Type

E-50. Sample area: 10.97 m2 – 3000 x 3655 mm

Rehearsal date: 01/18/2023

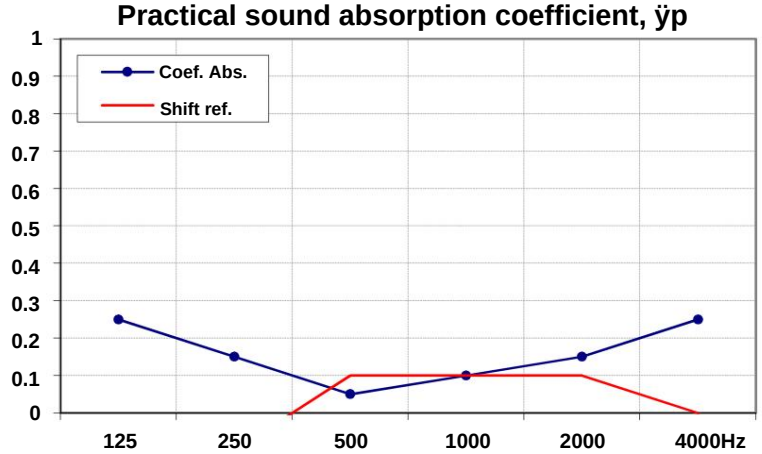
Acoustic absorption coefficient, ÿs



Acoustic absorption coefficient,ÿs

Freq. (Hz)	ÿs
100	0.32
125	0.26
160	0.21
200	0.16
250	0.15
315	0.10
400	0.08
500	0.07
630	0.07
800	0.07
1000	0.08
1250	0.10
1600	0.12
2000	0.13
2500	0.17
3150	0.20
4000	0.24
5000	0.25

Practical sound absorption coefficient, ÿp



Practical sound absorption coefficient, ÿp

Freq. (Hz)	ÿp
125	0.25
250	0.15
500	0.05
1000	0.10
2000	0.15
4000	0.25

Weighted sound absorption coefficient (UNE-EN ISO 11654:1998)
ÿW = 0.10 (LH)

It is strongly recommended to use the weighted sound absorption coefficient, ÿw, in combination with the complete sound absorption coefficient curve

Absorption classes acoustics according to ÿw (UNE-EN ISO 11654:1998)
A (>0.85)
B (0.80 to 0.85)
C (0.60 to 0.75)
D (0.30 to 0.55)
E (0.15 to 0.25)
Unclassified (<0.15)