

REPORT N. 054-2018-CR eng

UNI EN ISO 354:2003

ACOUSTIC ABSORPTION MEASUREMENT IN REVERBERATION ROOM

Issue place and date: Cerea (VR), 11/01/2019

Committee: SITLAND Spa

Address committee: Via Ca' Silvestre 52 - 36024 - Nanto (VI)

Sample delivery date: 24/07/2018

Sample provenance: SITLAND Spa

Sample installation date: 24/07/2018

Sample installed in laboratory by: Z Lab S.r.l. (sampling made by the committee)

Test date: 24/07/2018

Test location: Z Lab S.r.l. – Via Pisa, 7 – 37053 Cerea (VR) - Italia

Sampling denomination: Two-seater sofa model "CELL 128"

Mounting Type: Discrete elements

PREPARED	VERIFIED	APPROVED
Sabato Di Filippo	Antonio Scofano	Antonio Scofano

Sample description

The test sample is a two-seater sofa model "Cell 128".

The dimensions and materials are shown in the following figure (*):

Unit of measure: mm

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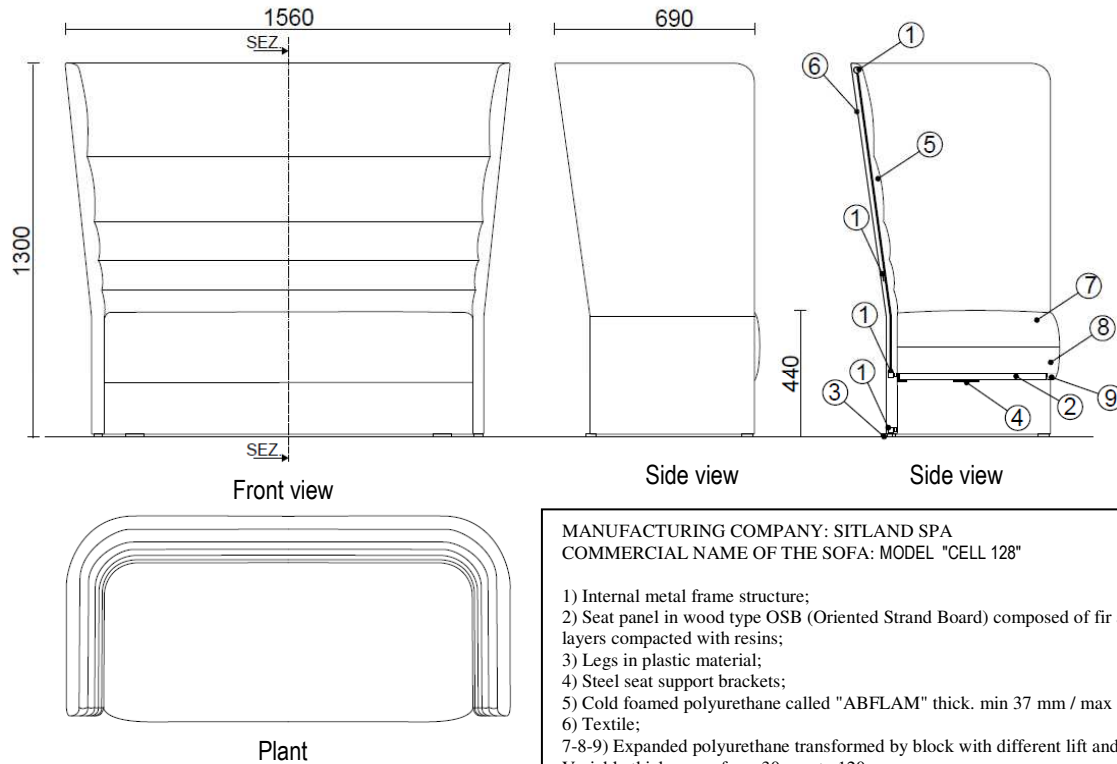


Figure 1_ Technical characteristics of the sample

(*) nominal data provided by the sample manufacturer

(**) data measured by test element sampling



Figure 2_ Two-seater sofa model "Cell 128".

(*) nominal data provided by the sample manufacturer
(**) data measured by test element sampling

Mounting conditions

The test specimen two-seater sofa model "Cell 128". was placed inside the reverberating room in 3 different locations the test chamber.

The distance provided by the regulations has been maintained: 2 meters between the three positions in the room and 1 meter from each test surface and microphone position.

The test sample characteristics are listed below (*):

<i>Length (mm)</i>	<i>Width (mm)</i>	<i>Height (mm)</i>
1560	690	1300

(*) nominal data provided by the sample manufacturer

(**) data measured by test element sampling

Test sample illustrations



Figure 3_ Reverberation Room Empty



Figure 4_ Reverberation Room with test objects

The test has been made as soon as the sample installation was completed.

Standards references

UNI EN ISO 354:2003

Acoustic - Absorption measurement in reverberation room

Test environment description

The test structure is made of reinforced concrete, completely insulated from the floor of the laboratory with anti-vibration supports. It is made up of a reverberating room of irregular shape and free of partition parallel to each other.

The dimensional data are listed below:

Average reverberation room dimensions (L x W x H)

700 X 560 X 370 cm

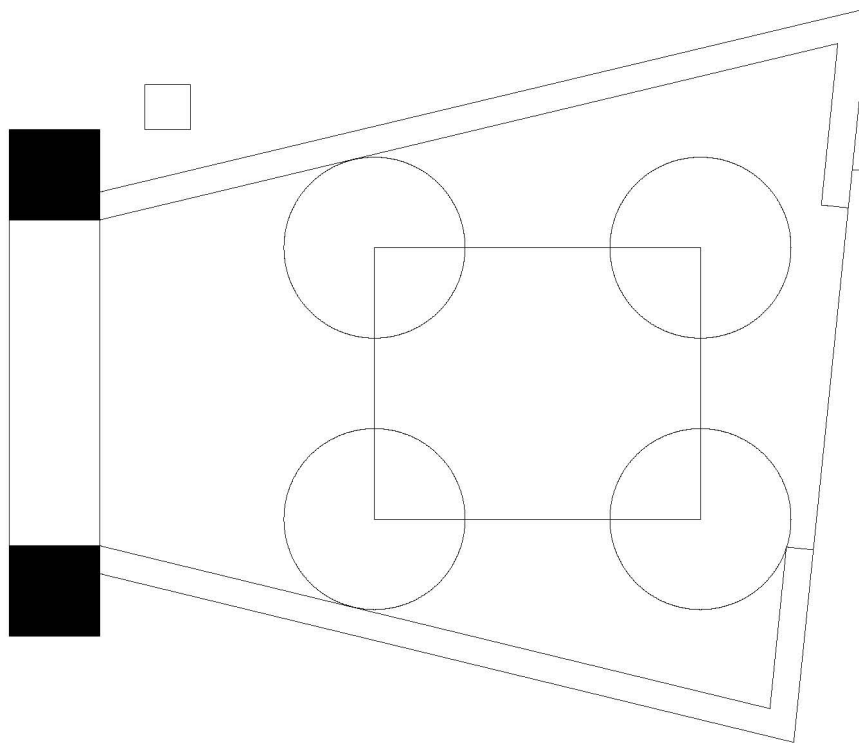


Figure 5_ Reverberation Room Scheme

Test equipment and instruments

Instrument	Model	Serial number
Sound Level Meter	LARSON DAVIS L&D 2900B	1080
Microphone	GRAS 40AQ	204027
Preamplifier	LARSON DAVIS L&D PRM900C	1267
Calibrator	LARSON DAVIS CAL200	3852
Omnidirectional source	BRUEL & KJAER 2719 + 4292	2571776 + 14012
Termohygrometer	DELTA OHM HD2301.0	09020599
Temperature and humidity sensor	DELTA OHM HP472AC R	09028736
Tape	STANLEY POWERLOCK 33-442	13/946

Environmental data during the test

	Reverberation room
Volume	161.3 m ³
Total surface	188.5 m ²
Average temperature during T ₁	29 ± 1,0 °C
Average relative humidity during T ₁	54 ± 2,0 %
Average temperature during T ₂	28 ± 1,0 °C
Average relative humidity during T ₂	57 ± 2,0 %

Where:

- T₁: Empty room reverberation time
- T₂: Room reverberation time with sample

Measurement method

The measurement of the sound absorption in the reverberation room is based on the principle of the difference between the reverberation times measured in the reverberation room in the presence of the material to be tested and in the empty reverberation room. The acoustic source, which produces pink noise, has been operated within the source room in 3 different positions, while the microphone is located in 4 different positions, both in the source room and in the receiving room. Three measurements for each source-microphone combination have been performed, for a total of 36 measurements in the empty room and 36 measurements in the sample room. The integration time, for each measure, has been at least 10 s.

After the measurements, the reverberation time of both rooms is calculated in any frequency band by evaluating the arithmetic average of the total number of measured reverberation times. The average reverberation time for the empty room and for the sample room, respectively T_1 and T_2 , is expressed with two significant digits.

The sample equivalent absorption area, A_T is then calculated using the formula:

$$A_T = A_2 - A_1 = 55,3 \cdot V \cdot \left(\frac{1}{c_2 T_2} - \frac{1}{c_1 T_1} \right) - 4 \cdot V \cdot (m_2 - m_1)$$

Where:

c_1 : is the sound speed in air at temperature t_1 , in m/s;

c_2 : is the sound speed in air at temperature t_2 , in m/s;

V : is the empty room volume, in m^3 ;

T_1 e T_2 : are the reverberation times for both the rooms;

m_1 e m_2 : are attenuation coefficients, depending on climate rooms conditions during the test.

When the test specimen comprises several identical objects, the equivalent sound absorption area A_{obj} of an individual object is found by dividing A_T by the number of objects, n :

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

Where:

A_T : equivalent sound absorption area in m^2 ;

n : number of test objects .

Measured values

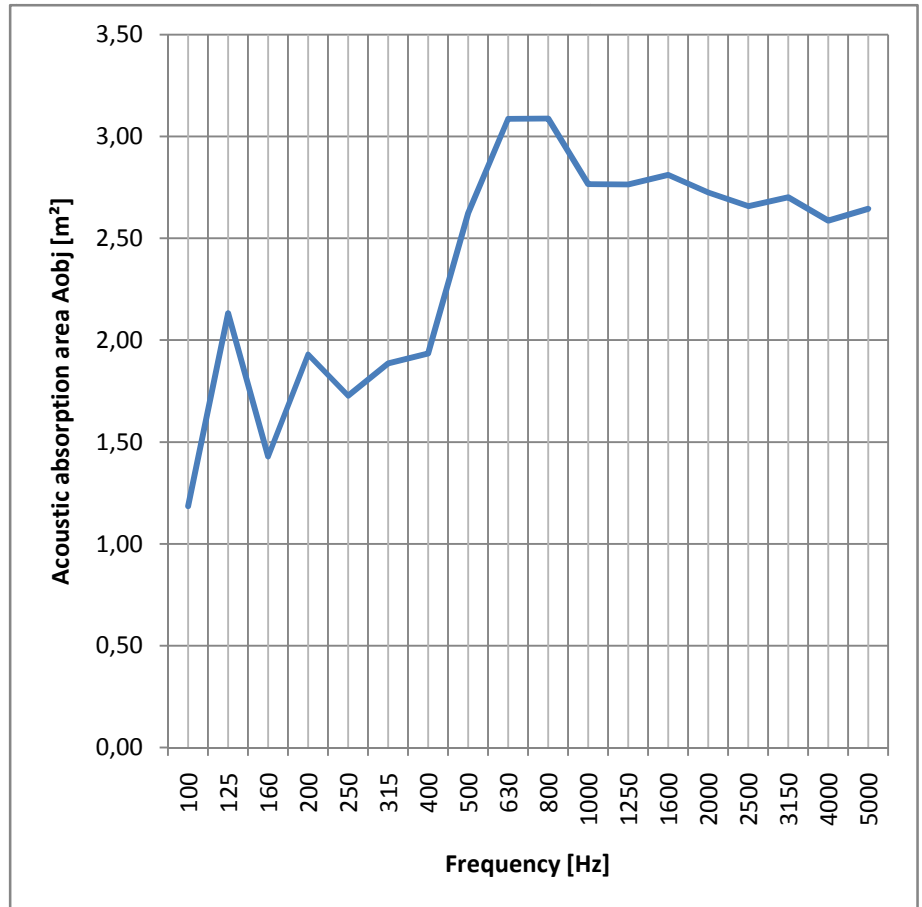
f [Hz]	T ₁ [s]	T ₂ [s]	A _T [m ²]
<i>Frequency</i>	<i>Empty room reverberation time</i>	<i>Sample room reverberation time</i>	<i>Equivalent absorption area</i>
100	4,30	3,59	1,18
125	4,83	3,45	2,13
160	5,86	4,42	1,43
200	6,45	4,34	1,93
250	6,47	4,51	1,73
315	6,02	4,17	1,89
400	5,45	3,86	1,93
500	5,31	3,44	2,62
630	5,32	3,24	3,09
800	5,05	3,14	3,09
1000	4,34	2,96	2,77
1250	4,11	2,85	2,76
1600	4,29	2,92	2,81
2000	4,20	2,91	2,72
2500	3,87	2,76	2,66
3150	3,39	2,50	2,70
4000	2,96	2,28	2,59
5000	2,34	1,89	2,64

Equivalent Sound Absorption of an individual object Aobj calculation in reverberation room according to UNI EN ISO 354

Sample description: Two-seater sofa model "CELL 128"
Mounting Type: Discrete elements

Reverberation room volume: 161.3 m³

f [Hz]	Aobj[m ²]
	<i>Equivalent sound absorption of an individual object values</i>
100	1,18
125	2,13
160	1,43
200	1,93
250	1,73
315	1,89
400	1,93
500	2,62
630	3,09
800	3,09
1000	2,77
1250	2,76
1600	2,81
2000	2,72
2500	2,66
3150	2,70
4000	2,59
5000	2,64



Evaluation based on laboratory measurement results by means of a technical method.

Laboratory Manager, Ing. Antonio Scofano